

INSTRUCTION MANUAL
MODEL 152
VARIPHASE GENERATOR
(WITH OPTIONS 005 AND 006)

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Option 005, IEE-488 Interface (GPIB), is documented in the rear of this manual. The words IEC and GPIB are interchangeable in this documentation. Option 006 is an additional set of Amplitude, Offset/Function and Phase boards for additional channel and requires no additional documentation.

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SAFETY

This instrument is wired for earth grounding via the facility power wiring. Do not bypass earth grounding with two wire extension cords, plug adapters, etc.

BEFORE PLUGGING IN the instrument, comply with installation instructions.

MAINTENANCE may require power on with the instrument covers removed. This should be done only by qualified personnel aware of the electrical hazards.

WARNING notes call attention to possible injury or death hazards in subsequent operation.

CAUTION notes call attention to possible equipment damage in subsequent operations.

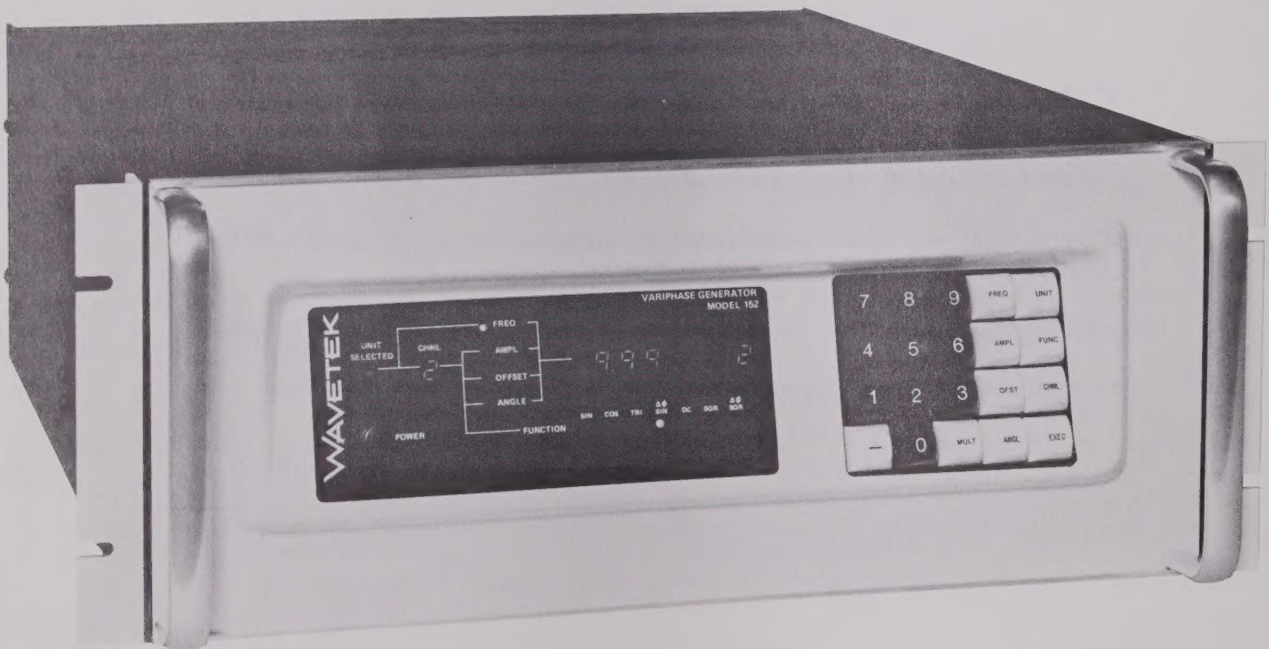


Figure i. Model 152 Variphase Generator

1

SECTION 1

INTRODUCTION

1.1 MODEL 152

The Model 152 Programmable Variphase Generator is a two channel precision source of selectable waveforms with variable phase relationship. Frequency programmed applies to all channels. Amplitude, offset, phase and waveform for each channel can be independently programmed. The phase relationship of the phase variable sine and phase variable square wave is referenced to a sync output and is variable with 0.1° resolution.

The generator is digitally controlled locally with front panel keyboard pushbuttons, and remotely with a selection of 21 ASCII (7-level) "typing" characters (with appropriate external interface). The effect of each control is digitally displayed on the front panel with red LED (light emitting diode) indicators. Numeric readout of frequency, offset and amplitude is in 3-digit scientific notation. Phase angle is displayed in 4 digits.

Sine, cosine, triangle, square, variphase sine and variphase square waveforms of frequencies from 1 Hz to 100 kHz plus dc and amplitudes from 10 mV peak to 9.99V peak can be generated.

Waveform center reference levels can be offset positive or negative from 10 mV to 9.99V and selected waveform phase, or polarity, can be inverted (180 degrees).

Along with the two low impedance ($< 1 \text{ k}\Omega$) rear panel channel (CH) outputs, which are the controlled waveform signal outputs, the generator delivers a square wave of the selected frequency for a synchronizing pulse output (SYNC OUT).

Analog inputs are received at the rear panel for external synchronization operation (SYNC IN).

Remote programming is accepted at a rear panel connector (EXT PROGRAM).

All programming (except phase angle) for one channel is stored in buffer registers while another channel is being programmed. When the programming is completed, an EXECUTE command will transfer data from all the buffer

registers to working registers, thus activating the digital to analog converters. In the case of phase angle programming, the phase angle program is accepted only for the last channel accessed.

Up to nine generators can be connected in parallel with one another as a multiple unit group. Each generator is internally configured with its own address, or unit select code, from 1 to 9. For example, an installation may have one master display and keyboard panel, which is used to address and command the slave generators. The status of the addressed generator would be displayed.

1.2 INTERFACE

The generator accepts TTL ground true 7-bit ASCII "typing" characters serially; the 7 bits of each character are accepted in parallel. A clock line in parallel with the data bits is used to clock in the data characters. Computer control is accepted as is keyboard control from another generator in multiple unit groups. With computer control, the generator keyboard control panel can be locked out, or disabled, to prevent control competition.

1.3 OPTIONS

Several interface options are available. They include input isolation and the General Purpose Interface Bus (GPIB).

1.4 ACCESSORIES

Accessories for the generators include interfaces for several minicomputers.

1.5 PHYSICAL DESCRIPTION

The mechanical characteristics of the Model 152 are given in paragraph 1.6.5. The standard model comes equipped with a 10 foot, 3 wire detachable power cord and rack mount adapters. Interface cabling requires Molex brand connectors (see paragraph 2.2.3); one is furnished.

1.6 SPECIFICATIONS

Specifications apply for control settings from 1.00 to 9.99.

1.6.1 Versatility

Waveforms

Sine , cosine , triangle , square , variphase sine, variphase square and dc selectable. All waveforms except triangle and variphase sine may be inverted by changing the polarity of the peak amplitude programming.

Frequency Range

1 Hz to 100 kHz in 5 ranges with 3 digit resolution.

10^0	1 Hz to 9.99 Hz
10^1	10 Hz to 99.9 Hz
10^2	100 Hz to 999 Hz
10^3	1 kHz to 9.99 kHz
10^4	10 kHz to 99.9 kHz

Main Output

DC voltage, ± 10 mV dc to ± 9.99 Vdc at 100 mA maximum. Output impedance less than 1Ω . Sine, cosine, triangle, square, variphase sine and variphase square, 10 mV peak to 9.99V peak at 100 mA peak maximum output current in 3 ranges (10^0 , 10^1 , 10^2). The output impedance is less than 1Ω and may be loaded by less than 1000 pF distributed capacitance in the form of connecting cables.

Variable Phase

One channel of variphase (sine or square) may be varied with respect to another variphase channel from 0° to 360° with 0.1° resolution. Phase angle may be varied with respect to sync in or sync out but accuracy is not defined.

DC Offset

All waveforms may be offset 9.99V above or below ground level with 3 digit resolution and selectable polarity. Signal level plus offset voltage must not exceed ± 9.99 V peak.

Sync Output

A TTL compatible 0.4 to 2.5V square wave output, which sinks 16 mA load current for up to 10 TTL loads. The positive rising edge of the square wave is in phase with zero degree phase of the sine wave.

Sync Input

Generator may be synchronized to an external time and amplitude symmetrical waveform of at least 1V peak and within 1% of the programmed frequency.

1.6.2 Accuracy

Horizontal Precision (Frequency Accuracy)

$\pm(1\% \text{ of program} + 0.1\% \text{ of range})$ for 1 Hz to 10 kHz.
 $\pm(2\% \text{ of program} + 0.1\% \text{ of range})$ for 10 kHz to 100 kHz.

Vertical Precision (Amplitude Accuracy)

Square and Variphase Square Waveforms:

$\pm(1\% \text{ of program} + 0.1\% \text{ of range})$ for 1 Hz to 10 kHz
 $\pm(3\% \text{ of program} + 0.1\% \text{ of range})$ for 10 kHz to 100 kHz

Sine, Cosine and Variphase Waveforms:

$\pm(3\% \text{ of program} + 0.1\% \text{ of range})$ for 1 Hz to 10 kHz
 $\pm(6\% \text{ of program} + 0.1\% \text{ of range})$ for 10 kHz to 100 kHz

Triangle Waveform:

$\pm(2\% \text{ of program} + 0.1\% \text{ of range})$ for 1 Hz to 10 kHz

NOTE

Vertical precision stated is for 10^0 amplitude multiplier. For 10^1 and 10^2 , add 2% per decade attenuation ± 5 mV dc offset.

DC Offset

$\pm(1\% \text{ of program} + 0.1\% \text{ of range})$.

Sine Wave Frequency Response

Amplitude change with frequency less than:

± 0.3 dB to 10 kHz
 ± 0.8 dB to 100 kHz

Phase Angle

Variphase Sine:

$\pm 0.3^\circ$ to 1 kHz
 $\pm 1^\circ$ to 10 kHz
 $\pm 4^\circ$ to 100 kHz

Variphase Square:

$\pm 0.5^\circ$ to 1 kHz
 $\pm 1.5^\circ$ to 10 kHz
 $\pm 5^\circ$ to 100 kHz

Frequency Stability

Short Term: $\pm 0.05\%$ for 10 minutes.

Long Term: $\pm 0.25\%$ for 24 hours.

1.6.3 Waveform Purity

Sine Wave Distortion (Total Harmonic Distortion)

Sine and Cosine Waveforms:

Less than 0.2% to 10 kHz
Less than 0.7% to 100 kHz

Variphase Sine Waveform:

Less than 0.25% to 10 kHz
Less than 0.8% to 100 kHz

Triangle Linearity

Greater than 99% to 10 kHz.

Square Wave Rise and Fall Time

Less than $3 \mu\text{s}$ for 20V p-p ($6.7 \text{ V}/\mu\text{s}$).

Total Aberrations

Less than 5% of program value ± 10 mV.

1.6.4 Environmental

Specifications apply for $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$. For operation from 0°C to $+50^{\circ}\text{C}$, derate all specifications by a factor of 2. Unit may be stored from -40°C to $+75^{\circ}\text{C}$ without damage.

1.6.5 Mechanical

May be used on the bench or in a 19 inch rack. Rack adapter hardware and program mating connectors included.

Dimensions

17¼ in./43.8 cm wide, 7 in./17.8 cm high, 23½ in./59.7 cm deep.

Weight

43 lb/19.5 kg net, 52 lb/23.6 kg shipping.

Power

90 to 110V, 105 to 125V, 180 to 220V or 210 to 250V;
50 Hz to 400 Hz. Less than 150 watts.

Programming Transition Time

Unit accepts bytes at a 1 MHz rate. The output will become

stable within 100 μs unless frequency, frequency range or phase angle is changed. For frequency and frequency range the output will be stable within 1 ms. For phase angle the output will be stable within 10 ms after receiving the next program prefix (e.g. A for amplitude).

Isolation

Signal ground and program ground are common in the standard 152. Optical isolation is available.

Logic Level Requirements

State	Requirements
Low (Logic "1")	0V to 0.4V sinking 25 mA maximum
High (Logic "0")	2.4V or open

NOTE

1. Open input is 3.0V.
2. Input is terminated by 220Ω to +5V and 330Ω to ground.
3. Recommended driver: SN 7438.

2

SECTION 2

INSTALLATION AND OPERATION

2.1 MECHANICAL INSTALLATION

After unpacking the instrument, visually inspect all external parts for possible damage to connectors, surface areas, etc. If damage is discovered, file a claim with the carrier who transported the unit. The shipping container and packing material should be saved in case reshipment is required.

The standard generator is a bench-top instrument with a collapsible tilt-bail to elevate its front end for convenient viewing.

The generator has rack mount adapters on the sides. For convenience, we recommend that users purchase a pair of chassis slides when rack mounting.

2.2 ELECTRICAL INSTALLATION

2.2.1 Power Connection

NOTE

Unless otherwise specified at the time of purchase, this instrument was shipped from the factory with the power transformer connected for operation on a 105 - 125 Vac line supply and with a 1½ amp slow-blow fuse.

Conversion for 90 to 110V, 180 to 220V or 210 to 250V operation requires resetting two switches on the rear panel. Set the two switches and select the fuse for the ac line voltage according to the following table.

AC Line Voltage	Switch A	Switch B	Fuse (SB)
90 - 110	115	LO	1½ amp
105 - 125	115	HI	1½ amp
180 - 220	230	LO	¾ amp
210 - 250	230	HI	¾ amp

Connect the ac line cord to the mating connector at the rear of the unit.

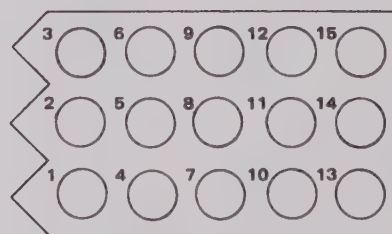
2.2.2 Signal Connections

Use 50Ω shielded cables equipped with female BNC connectors to distribute CH outputs, SYNC OUT and SYNC IN signals when connecting this instrument to associated equipment.

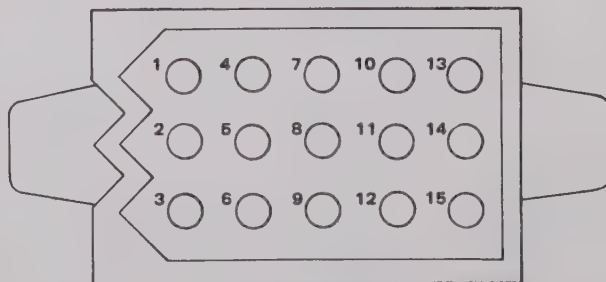
2.2.3 Control Connections

The remote (ASCII DATA IN/OUT) rear panel connection, harness wire colors, pin connections and signal names are given in tables 2-1 and 2-2.

The remote connector is a Molex 03-09-1151 which mates with a Molex 03-09-2151 connector housing with up to 15 Molex 02-09-2118 pin contacts. Pin contacts are prepared using a Molex Model A6973 Crimping Tool to connect No. 18 or No. 22 wire (strip back 1/10 to 1/8 inch).



MOLEX 03-09-1151



MOLEX 03-09-2151

Figure 2-1. Connectors (Socket/Pin Sides)

Table 2-1. ASCII DATA IN/OUT AND HARNESS CONNECTORS

Pin	Connector						Code	Color	Code	Color
	ASCII Data In/Out (Rear Panel)		Keyboard Harness		Display Harness		0	Black	8	Gray
	Wire Color	Signal	Wire Color	Signal	Wire Color	Signal				
1	1	PCOM					1	Brown	9	White
2	2						2	Red	90	White with black tracer
3	3	KINH	2	KINH			3	Orange	91	White with brown tracer
4			1	+5V	7	+5V	4	Yellow	92	White with red tracer
5	5	GND					5	Green	93	White with orange tracer
6	6	BUSY					6	Blue	94	White with yellow tracer
7	7	COM	91	COM	0	COM	7	Violet	95	White with green tracer
8	8	XD2	8	KD2	1	DCLK	PCOM: Input Program Common (connected to signal common unless isolation configuration) KINH: Keyboard Inhibit GND: Safety Ground BUSY: Not Ready for New Data COM: Signal Common or Keyboard Ground X: External D: Data 0 - 6: Bits 0 thru 6 CLK: Clock K: Keyboard D: Display			
9	9	XD4	5	KD4						
10	90	XD3	3	KD3	2	DD0				
11	91	XD1	7	KD1	4	DD2				
12	92	XD5	4	KD5						
13	93	XD0	90	KD0	6	DSYNC				
14	94	XD6	6	KD6	3	DD3				
15	95	XCLK	9	KCLK	5	DD1				

Table 2-2. KEY, ASCII, HEXADECIMAL AND BINARY CODES FOR PROGRAMMING FUNCTIONS

Control and Data Names	Model 152 Key	ASCII Character and TTY Keyboard	Hexa-Decimal Code	Binary (and ASCII Bus)							
				XD6 Bit 7	XD5 Bit 6	XD4 Bit 5	XD3 Bit 4	XD2 Bit 3	XD1 Bit 2	XD0 Bit 1	
Range (X 10 mult)*		(Space)	20	0	1	0	0	0	0	0	
Invert phase/offset	CHS	—	2D	0	1	0	1	1	0	1	
0	0	0	30	0	1	1	0	0	0	0	
1	1	1	31	0	1	1	0	0	0	1	
2	2	2	32	0	1	1	0	0	1	0	
3	3	3	33	0	1	1	0	0	1	1	
4	4	4	34	0	1	1	0	1	0	0	
5	5	5	35	0	1	1	0	1	0	1	
6	6	6	36	0	1	1	0	1	1	0	
7	7	7	37	0	1	1	0	1	1	1	
8	8	8	38	0	1	1	1	0	0	0	
9	9	9	39	0	1	1	1	0	0	1	
Peak amplitude	AMPL	A	41	1	0	0	0	0	0	1	
Output channel	CHNL	B	42	1	0	0	0	0	1	0	
Function (waveform)	FUNC	C	43	1	0	0	0	0	1	1	
Reference offset	OFST	D	44	1	0	0	0	1	0	0	
Range (X 10 mult)*	MULT	E	45	1	0	0	0	1	0	1	
Frequency	FREQ	F	46	1	0	0	0	1	1	0	
Unit select address	UNIT	G	47	1	0	0	0	1	1	1	
Phase angle	ANGL	H	48	1	0	0	1	0	0	0	
Execute	EXEC	I	49	1	0	0	1	0	0	1	

1 = True = Low
 0 = False = High
 TTL Voltage Level

*See the second entry of this control name.

2.2.4 Isolation and Keyboard Inhibit

The Model 152 may be controlled by a remote controller whose system ground reference is separated from the instrument signal common. With this isolation, the input program common remains separated from the instrument signal common. Most options include isolation; option 152-001 is the isolation only option. The optical isolators used provide up to 1500 volts of signal isolation. (Optical isolation reduces character programming rate to 10 kHz.)

Frame ground is connected to the instrument chassis and the third (green wire) pin on the power plug.

To disable the Model 152 keyboard, the keyboard inhibit line must be connected to the signal common. With most options, a programmable relay for disabling is provided to ensure isolation. The keyboard inhibit line nominal open circuit voltage is 3 volts with respect to signal common.

CIRCUIT OPERATION

3.1 INITIAL CHECKOUT

To ensure that the generator is operating properly, make the power and interface connections (Section 2). Operate the generator, function-by-function, as described in the following paragraphs.

3.2 CONTROLS, INDICATORS AND PROGRAMMING

The generator has a 20 pushbutton front panel keyboard to provide the same control as the 20 remotely programmed ASCII character bytes.

The 20 generator controls and their various code conversions are listed in table 2-2. The generator front panel controls and indicators are shown in figure i.

3.2.1 Power

Power is turned on and off with the PWR pushbutton. When the power is turned on, the generator is automatically addressed and is ready to accept commands. If a different generator is to be addressed, use the UNIT control (refer to paragraph 3.2.4). Also, when the power comes on, the generator is in standby state until properly programmed. While in this state, the display may show improper indications.

3.2.2 Indicators

The indicators turn on to show the various functions, values, sign and address programmed; the numerals displayed are significant as frequency, amplitude, phase angle or offset, but only one category at any one time. For frequency, amplitude and offset, scientific notation is displayed. (Scientific notation is (.)()() (), where the first three () are significant digits and the last () is a power of ten, a multiplier.) For phase angle, a 3 digit whole number and a 1 digit decimal are displayed; the power of ten display is always zero.

The digits are displayed in the order of entry, shifting right-to-left as shown in table 3-1. (Only the last entered set of significant digits and the last entered digit for the power of ten are stored for any given address, such as frequency, amplitude, etc. Any previously entered digits are shifted out of memory.)

Table 3-1. EXAMPLE OF PROGRAMMING

Sequence	Wavetek Keyboard	Remote ASCII	Lighted Display
1	UNIT	G	—
2	1	1	UNIT SELECTED
3	FREQ	F	FREQ
4	5	5	0.05
5	7	7	0.57
6	9	9	5.79
7	MULT	E	—
8	3	3	3 (Power of Ten)
9	CHNL	B	—
10	1	1	CHNL 1
11	FUNC	C	—
12	0	0	SIN
13	AMPL	A	AMPL
14	5	5	0.05
15	0	0	0.50
16	0	0	5.00
17	MULT	E	—
18	0	0	0 (Power of Ten)
19	EXEC	I	—

NOTE

The output signal will not appear until "EXEC" is commanded.

3.2.3 Programming

Programming is mostly a matter of prefixing, by sequence, the numerical values and numeric codes with their intended use. For example, programming a 5.79 kHz, 5.00V peak sine wave on Channel 1 of Unit No. 1 is given in table 3-1.

Generally, alpha characters (A thru I) are subsection addresses and are usually followed by one or more numeric digits representing a value or control selection.

A graphical representation of programming the 152 is shown in figure 3-1, where each programmed character allows

NOTE

Any character may be separated by spaces, periods or other characters not defined here. Spaces may be inserted between alpha control characters and numeric fields; however, a space will move from a value field to the exponent field (where scientific notation is used) after at least one numeric digit has been received. (See paragraphs 3.2.6 and 3.2.7.)



The 152 generates a busy signal while calculating sine and cosine values. The channel number cannot be changed while the busy signal is asserted.

If a phase angle value is followed by an execute, all registers except phase will be updated immediately and phase angles will be updated 1 to 2 ms later when the sine calculator provides the values.

The generators are designed to accept a scientific notation input format. Additional user information for system programming is included in Appendix A.

The following paragraphs describe the program elements and give their ASCII codes. The Model 152 front panel keys correspond one-for-one with the ASCII codes; if there is any doubt as to correspondence, refer to table 3-2.

Table 3-2. KEYBOARD TO ASCII CONVERSION TABLE

Keyboard	ASCII	Keyboard	ASCII
AMPL	A	MULT	(Space) or E
UNIT	G	ANGL	H
OFST	D	EXEC	I
CHNL	B	0 thru 9	0 thru 9
FUNC	C	CHS	— (Minus)
FREQ	F		

3.2.4 Unit Selected Address

After the unit prefix (G), program one digit to select the unit. The unit addressed in a multiple unit group responds to subsequent commands; other units do not. Generators are given the address of 3 at the factory unless specified otherwise at the time of purchase. Address changes are easily made in the field. Subsequent instructions will be accepted by the last unit addressed.

3.2.5 Function (Waveform)

Waveform	ASCII Character
Sine (SIN)	0
Cosine (COS)	1
Triangle (TRI)	2
Variphase sine ($\Delta\phi$ SIN)	3
DC	4
Square (SQR)	5
Variphase square ($\Delta\phi$ SQR)	6

After the function prefix (C), program one digit to select the desired waveform or DC voltage. Waveforms or DC voltage can be inverted during amplitude selection.

3.2.6 Frequency and Multiplier

After the frequency prefix (F), program a 3 digit number (1.00 to 9.99) for the three most significant digits; after the multiplier prefix (E or space), program the power of 10 (0 thru 4).

3.2.7 Amplitude and Multiplier

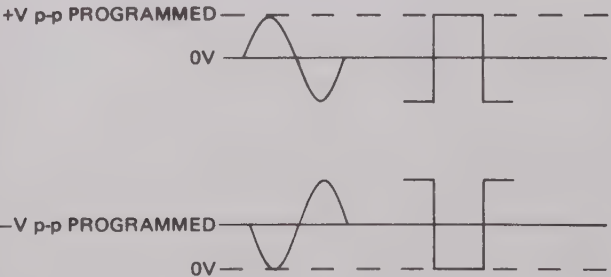
After the amplitude prefix (A), program (—) if waveform inversion is desired (triangle and variphase sin cannot be inverted); then, program a 3 digit number (0.00 to 9.99) for the three most significant digits. After the multiplier prefix (E or space), program the power of 10 (0, 1, 2 or 3). Powers 1, 2 and 3 are automatically accepted as -1 , -2 , and -3 . Amplitude programmed is peak voltage.

Function	Inversion	Power	Code
SIN	Yes	10^0	0
COS	Yes	10^{-1}	1
TRI	No	10^{-2}	2
$\Delta\phi$ SIN	No	10^{-3}	3
DC	Yes		
SQR	Yes		
$\Delta\phi$ SQR	Yes		

NOTE

DC offset plus waveform peak value may not exceed 100 mA peak load current.

All waveforms have a center reference level. Notice the inversion caused by programming $-V$ peak. Normal waveforms start in the positive direction regardless of their offset. Inverted waveforms start in the negative direction regardless of their offset.



3.2.8 Signal Reference Offset

After the offset prefix (D), program (—) if negative offset is desired; then, program a 3 digit number (0.00 to 9.99) for the offset.

Offset control allows the generator output reference level to be offset, or displaced positive or negative to 10V. All waveforms have a center reference level from which the offset is made.



NOTE

DC offset plus waveform peak value may not exceed 10V peak into an open circuit or 5V peak into 50Ω.

3.2.9 Phase Angle

After the phase angle prefix (H) program a 4 digit number (000.0 to 359.9) to change the phase angle of the channel programmed.

3.2.10 Execute

Programming execute (I) enables the output by transferring data from the program buffer to the working buffer.

3.3 OPERATING PROCEDURE

No preparation for operation is required beyond the completion of the initial installation checks. Allow the generator and associated equipment to warm up for specified generator accuracies. Refer to the control descriptions given in paragraph 3.2 for actual keyboard or remote commands.

NOTE

Use the same length of RG58 for all channel cables.

3.3.1 Operating as a Basic Waveform Generator

Simply program the desired waveform, frequency, amplitude and offset for each channel.

3.3.2 Operating as a DC Voltage Source

DC voltage output is $\pm 10V$, 100 mA obtained by using the DC function.

1. Select DC function.
2. Program the desired voltage and polarity.

3.3.3 Operating as a Variphase Generator

An output is phase shifted with respect to the sync output, sync input from another source or with respect to the other output channel.

NOTE

The accuracy of phase angle is defined between two variphase sine or square selected channels only.

1. Connect external sync if desired.
2. Program the desired waveform, frequency, amplitude and offset. (If external sync is used, sync and program frequencies must be within 1%. The waveform for the phase shifted channel must be either variphase sine or variphase square.)
3. Program the desired phase angle for the channel with the variphase waveform.

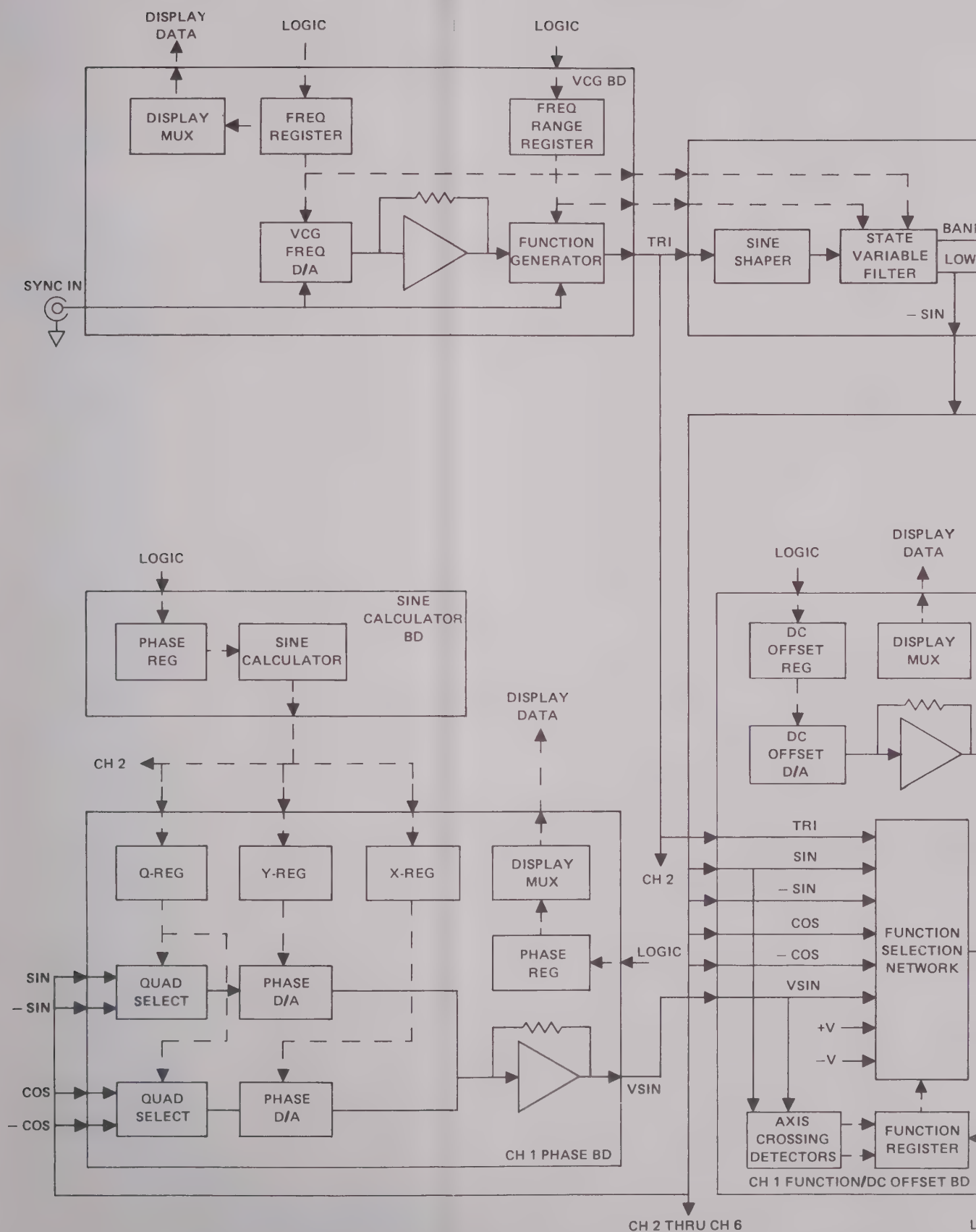
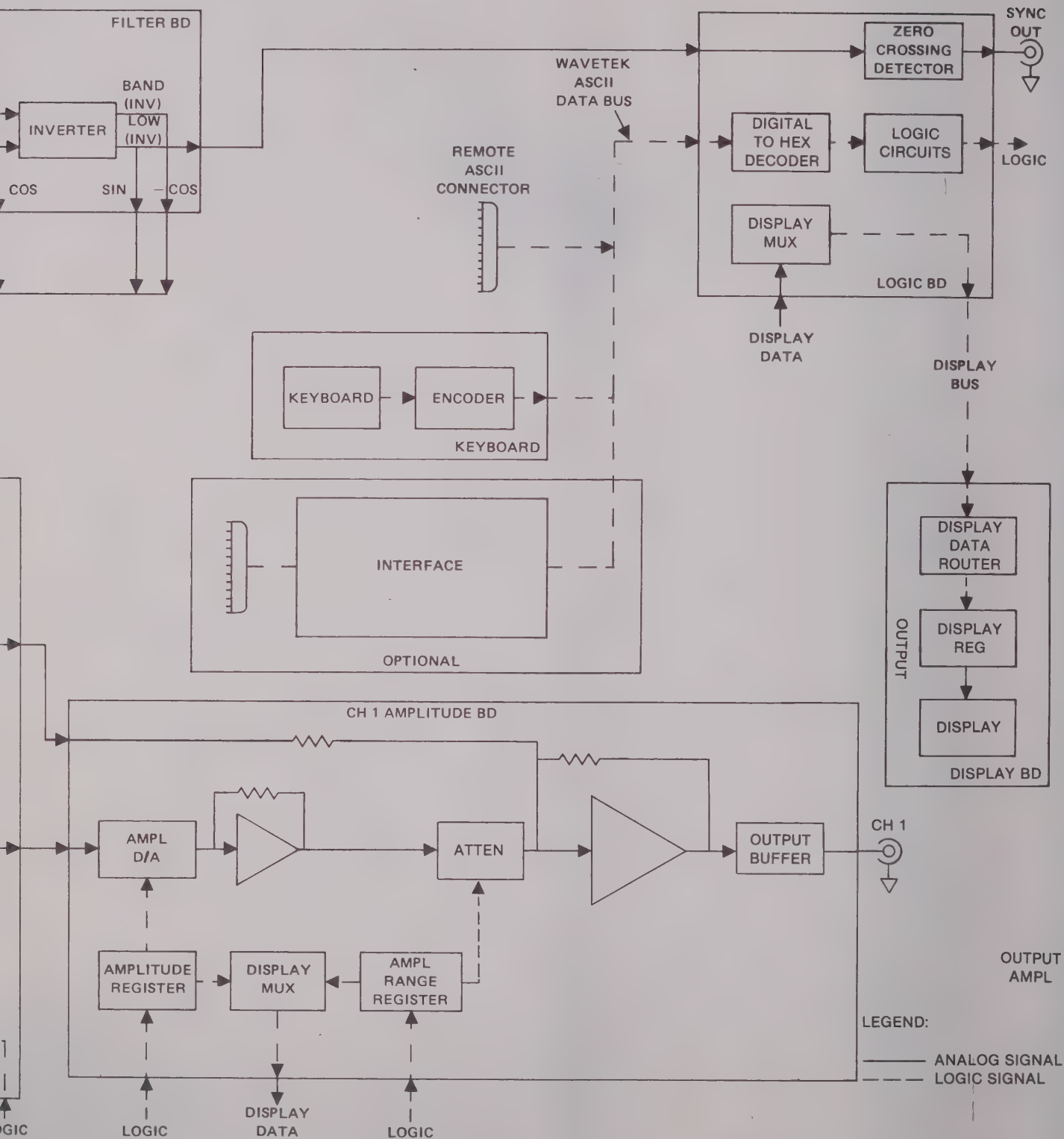


Figure 4-1. Overall Block Diagram



4

SECTION

CIRCUIT DESCRIPTION

4.1 LOGIC NOTATION AND TERMINOLOGY

To avoid confusion in determining logic states, please read and understand the following ground rules used in this manual.

1. On the schematics, all signals are true-when-high unless their mnemonics are overscored; the overscore indicates true-when-low.
2. Pulse and clock refer to transient change of state, whereas status refers to a logic state which requires new input to change.

4.2 BASIC OPERATION

The overall operation can be easily followed in figure 4-1. All digital programmed ASCII data, via the keyboard, the remote ASCII connector or optional interface card, is decoded into hexadecimal data on the logic interface board. The data is then distributed throughout the logic control circuitry to program all of the holding registers which control the operation of the generator. The SYNC OUT provides TTL compatible waveforms used for triggering purposes. The logic interface board also includes the data multiplexing circuitry for the display data. The display data is multiplexed into the display bus for display panel illumination. The routing of the correct data to the correct display is determined by a clock pulse and sync pulse on this bus.

The function generator generates symmetrical triangle and square waveforms simultaneously. Since this is a voltage controlled generator, the integrating current, frequency, is easily controlled with a D/A. The frequency range register selects the range integrating capacitor. The generator frequency can be synchronized to an external source through the SYNC IN BNC connector.

The triangle is fed to the filter board where it is shaped into a sine wave by diode nonlinearity. The state variable filter creates a sine/cosine relationship by using a frequency track-

ing bandpass and low pass filter. The filter outputs are buffered and inverted to create the quadrature components of the sinusoidal waveform.

To control the phase angle of the variphase sine wave, a fundamental trigonometric identity is used, $\sin(\omega t + \theta) = \cos \theta \sin \omega t + \sin \theta \cos \omega t$, where $\sin(\omega t + \theta)$ is an expression of relative signal amplitude of between 1 and -1 at time t when starting at angle θ . $\sin \omega t$ and $\cos \omega t$ are the sine and cosine functions created by the state variable filter where $\omega = 2\pi$ frequency. $\sin \theta$ and $\cos \theta$ are computed at the sine calculator board from the program phase angle θ . These computed values are transferred to the phase board where they are multiplied by $\sin \omega t$ and $\cos \omega t$ with the phase D/As. The phase D/A outputs are summed to create the $\sin(\omega t + \theta)$ variphase sine wave and then transferred to the offset/function board.

Axis crossing detectors are used to create TTL signals which are in phase with the sine and variphase sine waves. These TTL signals are fed into the function selection network via the function register and used to alternately select between the +V and -V inputs to the function selection network. When the square or variphase square waveforms are selected, the output of the function selection network will be a square wave with peaks equal to the $\pm V$ inputs of the function selection network. In other modes the function register will inhibit the axis-crossing created TTL signals and cause the function selection network to select one of the other six inputs besides the +V and -V inputs for output to the amplitude board.

This output is transferred to the amplitude board where the signal amplitude is controlled by means of the amplitude register and the amplitude D/A. The signal is then decade attenuated with a programmable amplifier before being fed into an output amplifier. The offset voltage from the offset D/A (function/offset board) is also injected at this summing node. The output amplifier consists of a fast differential input amplifier and a high current gain amplifier to provide $< 1\Omega$ output impedance and 100 mA maximum current capabilities.

5

SECTION 5

CALIBRATION

5.1 FACTORY REPAIR

Wavetek maintains a factory repair department for those customers not possessing the necessary personnel or test equipment to maintain the instrument. If an instrument is returned to the factory for calibration or repair, a detailed description of the specific problem should be attached to minimize turnaround time.

5.2 REQUIRED TEST EQUIPMENT

DVM
Oscilloscope, Dual Channel With Comparator
and Differential Inputs
Counter
Distortion Analyzer

5.3 CALIBRATION

After referring to the following preliminary data, perform calibration, as necessary, per table 5-1. If performing partial calibration, check previous settings and adjustments for applicability.

1. Refer to appropriate board assembly drawings for test point and adjustment locations.
2. TPs (Test Points) and adjustments are prefixed as follows:
 - A1 Power Supply
 - A2 VCG Board
 - A3 Filter Board
 - A4 Channel 1 Phase Board
 - A5 Channel 2 Phase Board

A6 Channel 1 Offset/Function Board
A7 Channel 2 Offset/Function Board
A9 Channel 1 Amplitude Board
A10 Channel 2 Amplitude Board

3. Before connecting the unit to an ac source, check the ac line circuit to make sure the 115/230 and HI/LO switches are set at the correct position (see paragraph 2.2.1).

CAUTION

To prevent component damage, turn off line power before removing and replacing circuit boards.

NOTE

When it is necessary to turn off power during calibration, programming will be lost. For correct programming after power-on, note programming at power-off or reestablish programming starting with paragraph 5.3, step 4.

4. Start the calibration by executing the following program:

Frequency	9.99E2	Channel	2
Channel	1	Amplitude	9.99E0
Amplitude	9.99E0	Offset	0.00
Offset	0.00	Function	0
Function	0	Angle	0
Angle	045.0	Execute	
Execute			
5. Allow the unit to warm-up at least 30 minutes prior to final calibration.
6. Open columns in table 5-1 indicate data from previous step remains applicable.

Table 5-1. CALIBRATION CHART

Seq	Check	Tester	Calibration Points	Program	Control	Desired Results	Remarks
1	Power supply regulation	DVM	Across A2C2 (neg side to DVM com)	See initial conditions	A1R28	+15 Vdc ±10 mV	Put VCG board on extender.
2			Across A2C4 (pos side to DVM com)		NA	-15V reading same as +15V reading ±5 mV	

Table 5-1. CALIBRATION CHART (Continued)

Seq	Check	Tester	Calibration Points	Program	Control	Desired Results	Remarks
3	Power supply regulation	DVM	Across A1C8 (6000 μ F) (neg terminal to DVM com)	See initial conditions	A1R2	+5.020 Vdc $\pm$ 5 mV	Put VCG board on extender.
4	Square wave time sym	Scope	A2TP6		A2R55	Horiz (time) sym error < 0.1%	
5					Freq 1.00E3		
6	Freq tracking	Counter	CH 1 BNC	Freq 9.99E3	A2R10	9.99 kHz	
7				Freq 1.00E3	A2R32	1.00 kHz	Repeat steps 6 and 7, as necessary, for correct adjustment.
8	Freq linearity			Freq 9.99E0	A2R10	9.99 Hz	
9				Freq 9.99E1		99.9 Hz	
10				Freq 9.99E2		999 Hz	
11				Freq 9.99E3		9.99 kHz	Leave A2R10 at best freq agreement on these ranges.
12				Freq 5.00E4	A2C41	50.00 kHz	
13				Freq11.00E4 thru 9.99E4 in 2.25 increments		Best linearity	
Replace VCG board and put filter board on extender. Ensure that no external sync cable is connected to scope.							
14	Distortion	Scope (differential input)	A3 1V SINE TP	Freq. 9.99E2 A2R3 Centered	A3R22 A3R23	$\pm$ 0.5V peaks $\pm$ 2 mV	
15		Distortion analyzer			A3R2 A3R22	Lowest distortion with smooth residue (minimum 2nd harmonic)	
16		Scope (differential input)			A3R23	1.00V p-p $\pm$ 4 mV	

Table 5-1. CALIBRATION CHART (Continued)

Seq	Check	Tester	Calibration Points	Program	Control	Desired Results	Remarks
17	Filter balance	Scope (differential input)	A3C37 (sin)	Freq 9.00E3	A3R60	No dc offset	Connect scope probe to front side of capacitor.
18				Freq 1.09E3	A3R114		
19				Freq 1.90E3	A3R113		
20			A3C44 (cos)	Freq 9.00E3	A3R52		
21				Freq 1.09E3	A3R55		
22				Freq 1.90E3	A3R64		
23			A3C37 (sin)	Freq 9.99E3		< 10 mV offset	If > 10 mV, repeat steps 17 - 23.
24							
25	Filter buffers		A3 + SINE TP	Freq 8.00E2	A3R30 A3R110	±5.000 Vp ±5 mV	Connect scope probe to test point.
26			A3 – SINE TP		A3R112		
27			A3 – COS TP		A3R29 A3R106		
28			A3 + COS TP		A3R108		
29	Filters freq E4 balance		A3 + SINE TP A3 – COS TP	Freq 5.00E4	A3C41	+ sin, – cos ampl = to each other	Ensure scope probe is properly compensated for HF measurements.
30					A3C48 A3R25	+ sin and – cos amplitudes ±5.000V ±20 mV peak	
31					Freq 9.99E4	±5.00V ±100 mV peak + sin and – cos	

Table 5-1. CALIBRATION CHART (Continued)

Seq	Check	Tester	Calibration Points	Program	Control	Desired Results	Remarks
32	Filters freq E4 balance	Scope (dif- ferential input)	A3 + SINE TP A3 – COS TP	Freq 9.99E4	A3R25	±5.00V ±100 mV peak + sin and – cos	Repeat steps 30, 31 and 32 until + sin and – cos amplitudes track within ±200 mV of ±5V from freq 1.00E4 thru 9.99E4.
33	CH 1 phase		A4TP1	Freq 8.00E2	A4R1 A4R2	±5.000 Vp ±5 mV	Replace filter board and put channel 1 phase board on extender.
34	CH 2 phase		A5TP1		A5R1 A5R2		Replace channel 1 phase board and put channel 2 phase board on extender.
35	CH 1 offset	DVM	A6TP1	CH 1 Func 4 Ampl 0.00E0 Ofst 9.99	A6R3	–9.99 Vdc	Replace channel 2 phase board and put channel 1 ofst/func board on extender.
36				Ofst –9.99	A6R4	+9.99 Vdc	Program – key.
37	CH 1 amplitude		A9TP5	Func 5 Freq 0.50E0 Ampl 9.99E0 Ofst 0.00	A6R2 A6R1	+9.99V + peak –9.99V – peak	
38	Ch 2 offset		A7TP1	Ch 2 Func 4 Ampl 0.00E0 Ofst 9.99	A7R3	–9.99 Vdc	Replace channel 1 ofst/func board and put channel 2 ofst/ func board on ex- tender.
39				Ofst –9.99	A7R4	+9.99 Vdc	
40	CH 2 amplitude		A10TP3	Func 5 Ampl 9.99E0 Ofst 0.00	A7R2 A7R1	+9.99V + peak –9.99V – peak	
41	CH 1 out- put ampl		CH 1 BNC	Ch 1 Freq 0.50E0 Ampl 0.00E3 Ofst 0.00 Func 4	A9R59	0.00 Vdc ±5 mV	Put CH 1 ampl board on extender.
42				Ampl 0.00E2	A9R55		
43				Ampl 0.00E1	A9R69		

Table 5-1. CALIBRATION CHART (Continued)

Seq	Check	Tester	Calibration Points	Program	Control	Desired Results	Remarks
44	CH 1 out-put ampl	DVM	CH 1 BNC	Ampl 0.00E0 Func 5	A9R65	0.00 Vdc ±5 mV	
45				Ampl 9.99E0	A9R78	19.98V p-p square	Set A9R78 so that the ± peak ampli- tudes give a magni- tude of 19.98V.
46	CH 1 out-put offset			Ampl 0.00E0 Ofst 9.99	A9R81	9.99 Vdc ±5 mV	
47				Ofst -9.99		-9.99 Vdc ±10 mV	A9R81 may be reset for best results be- tween ± ofst.
48	CH 2 out-put ampl		CH 2 BNC	CH 2 Ampl 0.00E3 Ofst 0.00 Func 4	A10R59	0.00 Vdc ±5 mV	Replace channel 1 ampl board and put channel 2 ampl board on extender.
49				Ampl 0.00E2	A10R55		
50				Ampl 0.00E1	A10R69		
51				Ampl 0.00E0	A10R65		
52		Scope (dif-ferential input)		Ampl 9.99E0	A10R78	19.98V p-p square	Set A9R78 so that the ± peak ampli- tudes give a magni- tude of 19.98V.
53	CH 2 out-put offset	DVM		Ampl 0.00E0 Func 4 Ofst 9.99	A10R81	+9.99 Vdc ±5 mV	
54				Ofst -9.99		-9.99 Vdc ±10 mV	A10R81 may be re- set for best results between ± ofst.

6

SECTION

PARTS AND SCHEMATICS

6.1 DRAWINGS

The following assembly drawings (with parts list) and schematics are in the arrangement shown below.

6.2 ORDERING PARTS

When ordering spare parts, please specify part number, circuit reference, board, serial number of unit and the function performed.

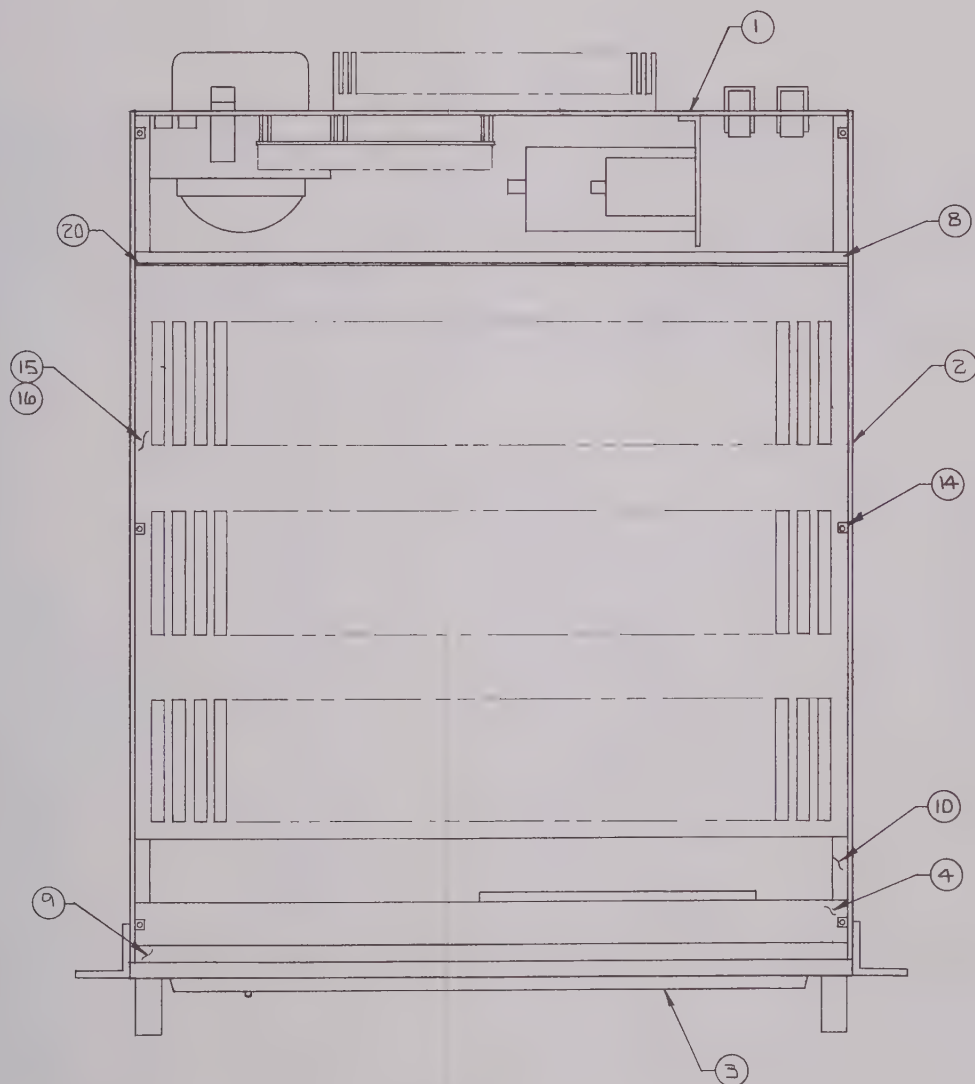
6.3 ADDENDA

Under Wavetek's product improvement program, the latest electronic designs and circuits are incorporated into each Wavetek instrument as quickly as development and testing permit. Because of the time needed to compose and print instruction manuals, it is not always possible to include the most recent changes in the initial printing. Whenever this occurs, addendum pages are prepared to summarize the changes made and are inserted immediately inside the cover.

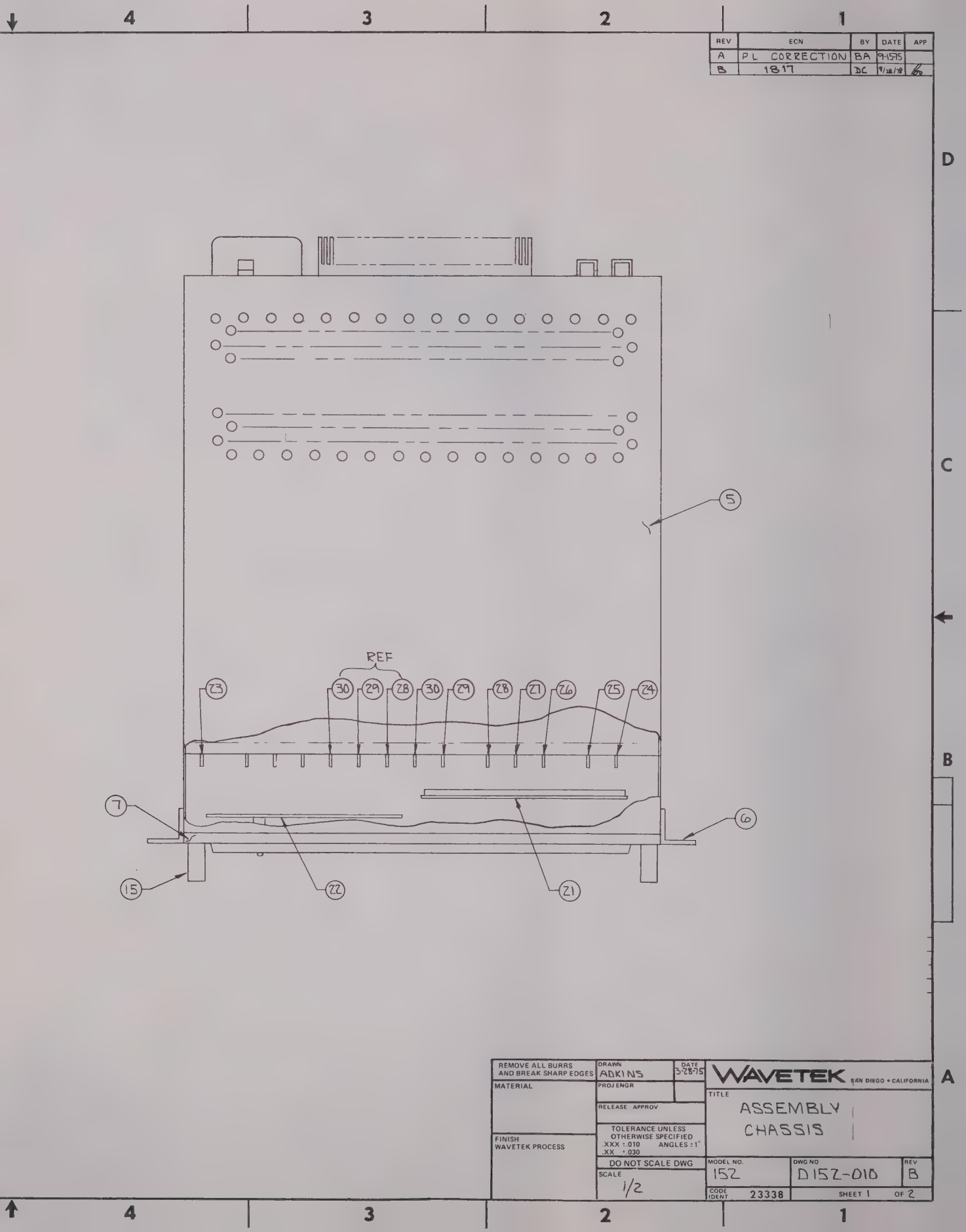
Drawing	Drawing No.
Chassis Assembly	152-010
Chassis Parts List	1101-00-0664
Power Supply Assembly	152-046
Power Supply Parts List	1101-00-0669
Power Supply Board Schematic	152-236
Power Supply Board Assembly	152-036
Power Supply Board Parts List	1100-00-0153
Display Board Schematic	152-254
Display Board Assembly	152-054
Display Board Parts List	1100-00-0149
Keyboard Schematic	152-256
Keyboard Assembly	152-056
Keyboard Parts List	1100-00-0154
Mother Board Assembly	152-034
Mother Board Parts List	1100-00-0670
Logic Interface Board Schematic	152-245
Logic Interface Board Assembly	152-045
Logic Interface Board Parts List	1100-00-0152

Drawing	Drawing No.
Sine Calculator Board Schematic	152-255
Sine Calculator Board Assembly	152-055
Sine Calculator Board Parts List	1100-00-0672
VCG Board Schematic	152-230
VCG Board Assembly	152-030
VCG Board Parts List	1100-00-0145
Filter Board Schematic	152-232
Filter Board Assembly	152-032
Filter Board Parts List	1100-00-0146
Phase Board Schematic	152-226
Phase Board Assembly	152-026
Phase Board Parts List	1100-00-0150
Offset, Function Board Schematic	152-227
Offset, Function Board Assembly	152-027
Offset, Function Board Parts List	1100-00-0148
Amplitude/Logic Board Schematic	152-228
Amplitude/Logic Board Assembly	152-028
Amplitude/Logic Board Parts List	1100-00-0147

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NOTE: UNLESS OTHERWISE SPECIFIED



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REFERENCE DESIGNATION

- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- NONE
- NONE
- NONE
- NONE
- 16
- 17
- NONE
- 20

WAVETEK
PARTS LIST

REFERENCE DESIGNATION

- 15
- NONE
- NONE
- 14
- NONE
- NONE

WAVETEK
PARTS LIST

NOTE: UNLESS OTHERWISE SPECIFIED

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1

REV

ECN

BY

DATE

APP

PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
SIDE PLATE	152-316	WVTK	1400-00-8492	2
FRONT PANEL	152-324	WVTK	1400-00-8500	1
SUB PANEL	152-321	WVTK	1400-00-8513	1
COVER, TOP	152-319	WVTK	1400-00-8522	1
EARS, RACKMOUNT	152-318	WVTK	1400-00-8532	2
TRIM	152-314	WVTK	1400-00-8541	2
BAR, SUPPORT, MOTHER	152-308	WVTK	1400-00-8553	2
BAR, SUPPORT, PANEL	152-322	WVTK	1400-00-8563	2
BAR, SUPPORT, SIDE	152-315	WVTK	1400-00-8573	4
PANEL, DISPLAY FROM: 1400-00-0691	1400-00-8580	WVTK	1400-00-8580	1
COVER, BOTTOM	1400-00-8932	WVTK	1400-00-8932	1
BRACKET, FAN SUPPORT	1400-00-9213	WVTK	1400-00-9213	1
BRACKET, PWR, SWITCH	1400-00-9233	WVTK	1400-00-9233	1
GUIDE, BOARD	115-287	CALMK	2100-06-0004	90
GUIDE PLATE	115-1123A	CLMRK	2100-06-0005	2
FAN	760-126LF-2182-11115	ETRI	2600-00-0006	1
TY-WRAP	TYB-23M	TB	2800-00-0006	10

TITLE

CHASSIS

ASSEMBLY NO.

1101-00-0664

PAGE: 1

REV

C

PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT	
HANDLE	1052	USECO	2800-07-0019	2	
BAIL W/FEET, 15 1/2	BAIL 15 1/2	BUKEY	2800-08-0001	1	
INSERT #8	74-11-108-13	SOTCO	2800-09-0018	6	
FAST, CHASSIS	1591-C11	USECO	2800-09-0022	12	
INSERT #10	74-11-210-13	SOTCO	2800-09-0026	8	
PLUG BUTTON	48152	UNCAR	2800-35-0001	3	
TITLE CHASSIS		ASSEMBLY NO. 1101-00-0664 PAGE: 2		REV C	

REMOVE ALL BURRS AND BREAK SHARP EDGES		DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA TITLE PARTS LIST CHASSIS	
MATERIAL		PROJ ENGR			
		RELEASE APPROV			
		TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES: 1° .XX ±.030			
FINISH WAVETEK PROCESS		DO NOT SCALE DWG		MODEL NO. 152	DWG NO. 1101-00-0664
		SCALE		REV C	
		CODE IDENT 23338		SHEET	OF 1

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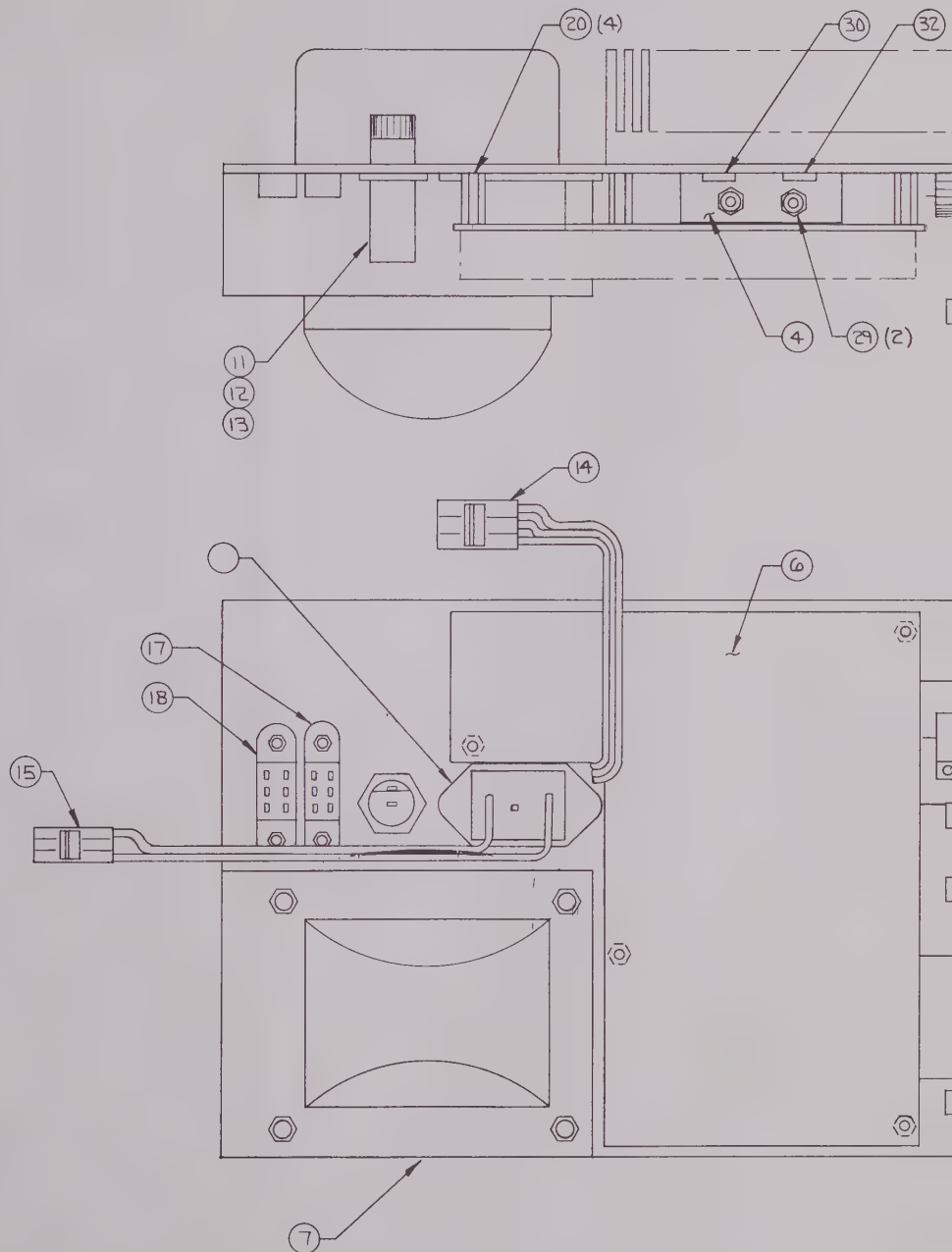
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⚠ USED WHEN IEC INTERFACE IS INSTALLED ONLY.

3. FOR TRUE WIRING SEE SHT 2 & 3.

2. REAR CANN. MTG. PLATE (ITEM 2) IS LAST ASSY TO BE MOUNTED ON REAR PANEL.

1. WIRES FROM 9 & 15 PIN MOLEX SHOWN FOR REF ONLY.
APPROX. WIRE CORSE.

NOTE: UNLESS OTHERWISE SPECIFIED

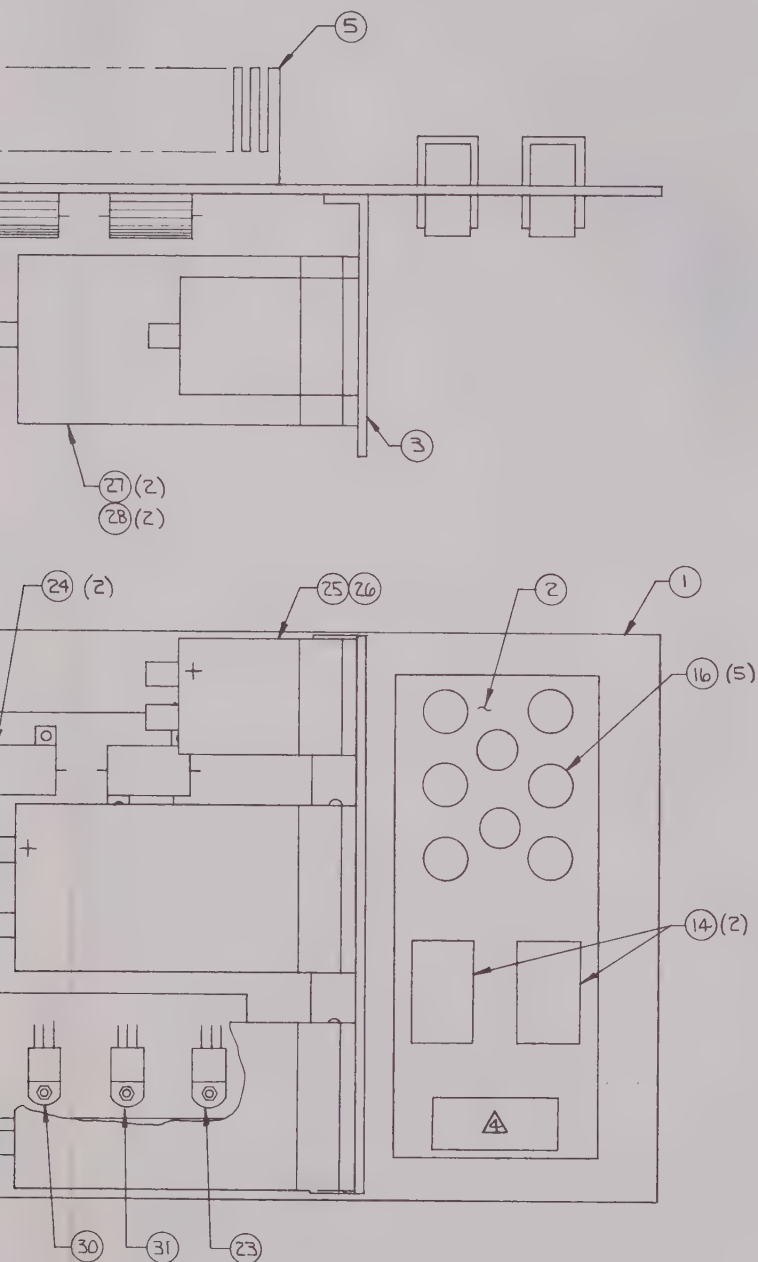
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REV	ECN	BY	DATE	APP
A	NEW 8BNC PLATE	BA	9-15-75	



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REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN ADKINS	DATE 3-10-75	WAVETEK SAN DIEGO • CALIFORNIA	
MATERIAL	PROJ ENGR		TITLE ASSEMBLY POWER SUPPLY	
	RELEASE APPROV			
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030			
	DO NOT SCALE DWG			
SCALE 1/1	MODEL NO 152		DWG NO D152-046	REV A
	CODE IDENT 23338		SHEET 1 OF 4	

4

3

2

1

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D

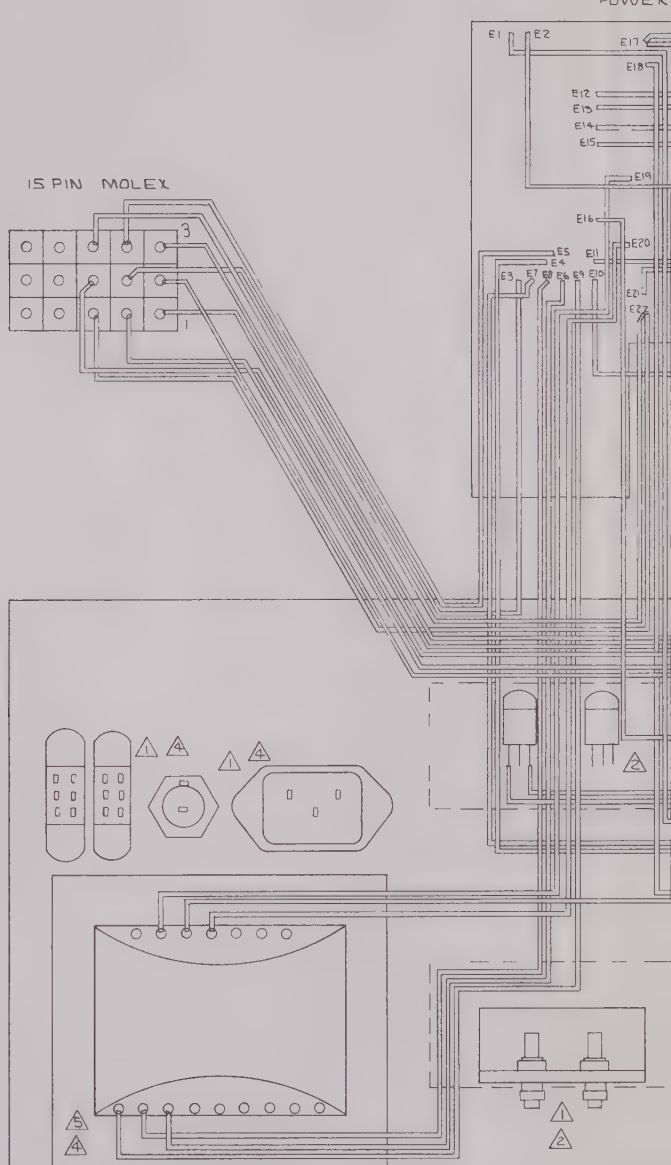
C

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15 PIN MOLEX



7. POWER SUPPLY BD. AND CAPACITORS SHOWN REMOVED FROM REAR PANEL.

6. ADD WIRE TIES AS REQUIRED

⚠ ASSEMBLE LARGE CAPACITORS, (ON BRACKET), TRANSFORMER, AND POWER SUPPLY BD, (ASSEMBLED), TO REAR PANEL.

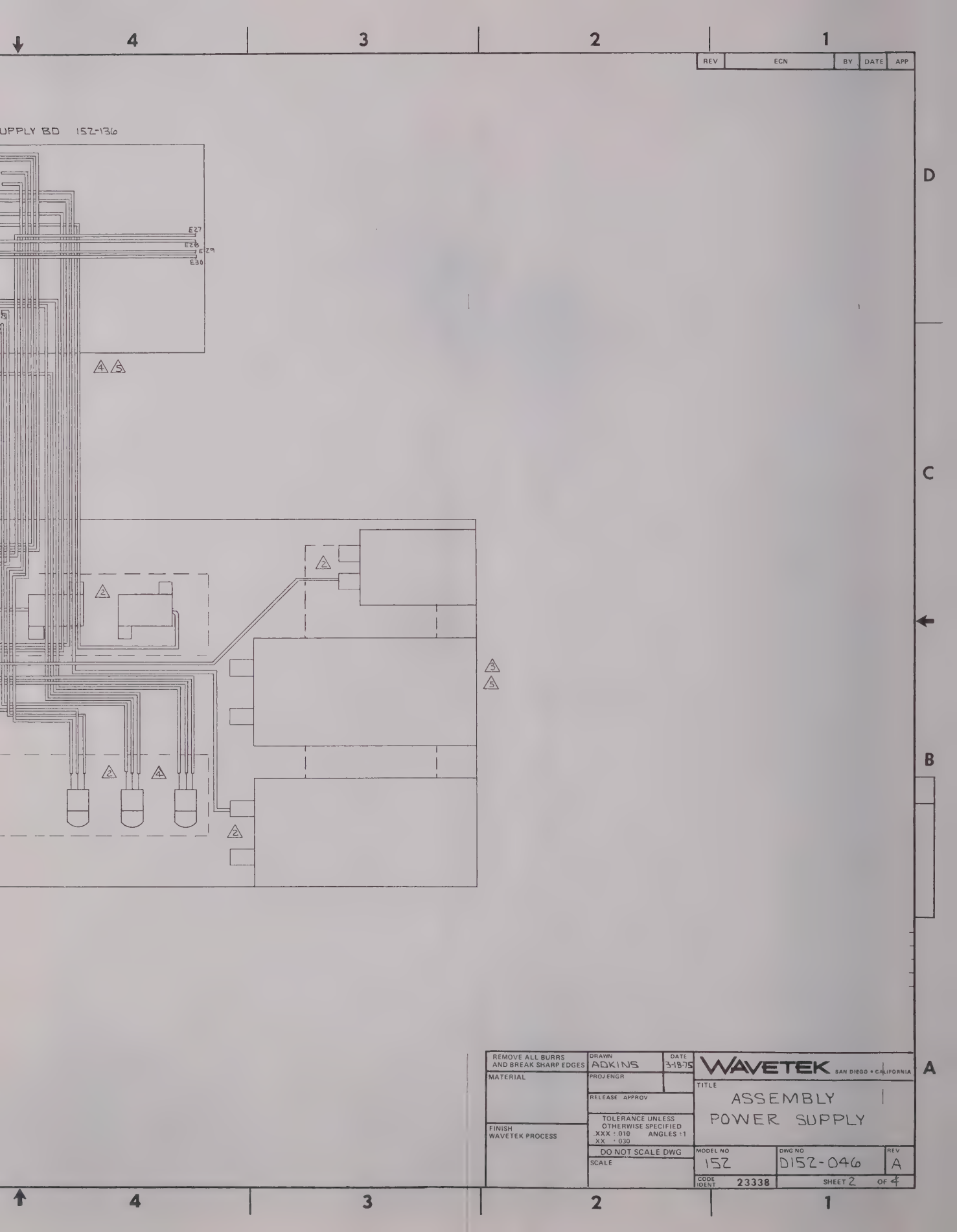
⚠ INSTALL AND SOLDER ALL HARNESSSES.

⚠ MOUNT LARGE CAPACITORS TO MOUNTING BRACKET.

⚠ SOLDER TIP'S 20W RESISTORS SOLDER LUGS FOR LARGE CAPACITORS AND TRANSISTORS TO WIRE HARNESS.

⚠ INSTALL TRANSISTORS SWITCHES FUSE HOLDER AND A.C. RECEPTICAL TO REAR PANEL.

NOTE UNLESS OTHERWISE SPECIFIED



SUPPLY BD 152-136

E27
E28
E29
E30

REV	ECN	BY	DATE	APP
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REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN ADKINS	DATE 3-18-75	WAVETEK SAN DIEGO • CALIFORNIA		
MATERIAL	PROJ ENGR		TITLE ASSEMBLY 1 POWER SUPPLY		
FINISH WAVETEK PROCESS	RELEASE APPROV				
	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX : .010 ANGLES : 1 XX : .030				
	DO NOT SCALE DWG		MODEL NO 152	DWG NO D152-046	REV A
SCALE			CODE IDENT 23338	SHEET 2 OF 4	

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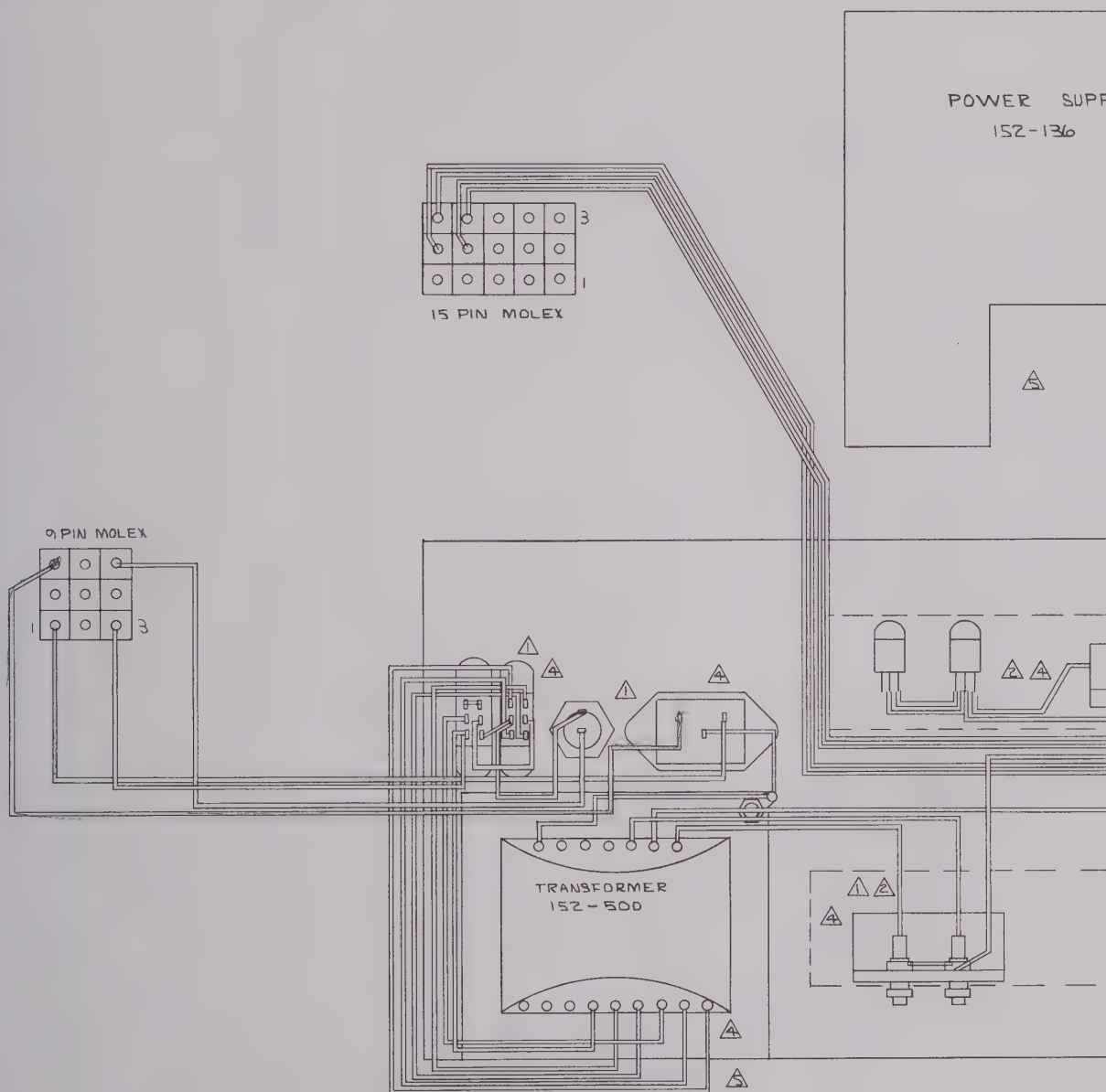
D

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7 POWER SUPPLY BD. AND CAPACITORS SHOWN REMOVED FROM REAR PANEL.

6. ADD WIRE TIES AS REQUIRED.

⚠ ASSEMBLE LARGE CAPACITORS, (ON BRACKET) TRANSFORMER, AND POWER SUPPLY BD. (ASSEMBLED) TO REAR PANEL.

⚠ INSTALL AND SOLDER ALL HARNESES.

⚠ MOUNT LARGE CAPACITORS TO MOUNTING BRACKET.

⚠ SOLDER TIP'S, 20W RESISTORS, SOLDER LUGS FOR LARGE CAPACITORS AND TRANSISTORS TO WIRE HARNESS.

⚠ INSTALL TRANSISTORS, SWITCHES, FUSE AND AC. RECEPTICAL TO REAR PANEL.

NOTE: UNLESS OTHERWISE SPECIFIED

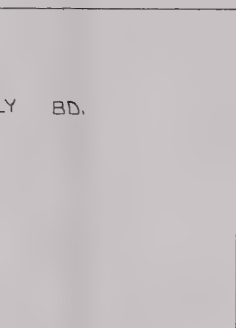
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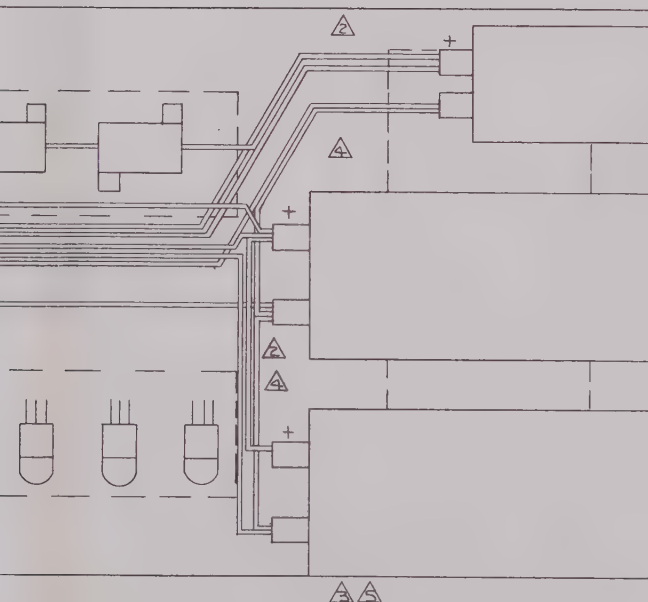
2

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REV ECN BY DATE APP



LY BD.



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REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN ADKINS	DATE 3-18-75	WAVETEK SAN DIEGO • CALIFORNIA	
MATERIAL	PROJ ENGR	RELEASE APPROV	TITLE ASSEMBLY POWER SUPPLY	
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 ANGLES :1° XX + .030		MODEL NO. 152	
	DO NOT SCALE DWG		DWG NO. D152-046	REV A
	SCALE		CODE IDENT 23338	SHEET 3 OF 4

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A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFR-PART
NONE	TRANSFORMER	152-500
NOE	NAMEPLATE	147-334
NONE	STANDOFF	201-333
NONE	REAR PANEL	152-310
NONE	PLATE,CONN MTG	152-331
NONE	BRACKET,CAPACITOR	152-312
NONE	HEATSINK,TRANSISTOR	152-307
NONE	HEATSINK REF:3200-06-0002	152-311
NONE	COVER,CONN.PLATE	1400-00-9192
NONE	CAP,ELEC,18000MF,25V	91C25JC183
NONE	CAP,ELECT,600MF,10V	91C10HA63
NONE	BNC CONN	KC-7946
NONE	CONN,9PIN	03-06-1091
NONE	CONN,15PIN	03-09-1151
NONE	RECEPT,POWER	EAC-301
NONE	TERM,LOCK LUG	1414-4
NONE	TERM,LOCK LUG	1414-8
WAVETEK PARTS LIST		TITLE REAR PANEL
		AS 11 PA

NOTE: UNLESS OTHERWISE SPECIFIED

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REV

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BY

DATE

APP

NO

MFGR

WAVETEK NO.

QTY/PT

WVTK

1204-00-0025

1

WVTK

1400-00-3620

1

WVTK

1400-00-4173

4

WVTK

1400-00-8590

1

WVTK

1400-00-8603

1

WVTK

1400-00-8613

1

WVTK

1400-00-8623

1

WVTK

1400-00-8633

1

WVTK

1400-00-9192

1

STM

1500-31-8302

2

STM

1500-36-0201

1

KING

2100-01-0002

5

MOLEX

2100-02-0010

1

MOLEX

2100-02-0012

1

SWCFT

2100-03-0005

1

SMITH

2100-04-0008

1

SMITH

2100-04-0010

1

ABLY NO.

1101-00-0669

REV

A

REFERENCE DESIGNATORS

PART DESCRIPTION

ORIG-MFGR-PART-NO

MFGR

WAVETEK NO.

QTY/PT

NONE

SOLDER LUG

1497

SMITH

2100-04-0012

5

NONE

LUG # 8

35

ILSCO

2100-04-0018

6

NONE

PIN,FEMALE

02-06-1103

MOLEX

2100-05-0002

4

NONE

PIN,FEMALE

02-09-1118

MOLEX

2100-05-0026

13

NONE

FUSE HOLD

345001

LITFU

2400-05-0012

1

NONE

FUSE,250V,1.5A,FB

31201.5

LITFU

2400-05-0019

1

NONE

TY-WRAP

TYB-23M

TB

2800-00-0006

20

NONE

CABLE CLAMP

835

SMITH

2800-00-0010

1

NONE

RETAINER,SPRING

D-191

WEKSR

2800-09-0007

1

NONE

INSERT # 6

74-11-106-13

BOICO

2800-09-0017

14

NONE

CAP,MTG,BKT

FJMR

STM

2800-12-0006

2

NONE

CAP,MTG,BKT

FHMR-2

STM

2800-12-0007

1

NONE

WASHER,SHOULDER

2668

SMITH

2800-27-0004

10

NONE

RES,MF,1/4W,1%,10

RN60D-10R0F

TRW

4701-13-1009

1

NONE

RES,WW,25W,1%,.1 OHM

RE70GR100-.1 OHM,1%

DALE

4702-93-0019

2

NONE

DIODE

1N1199A

MOT

4806-01-1199

2

NONE

TRANS

TIP-33

TI

4902-00-0330

2

WAVETEK

PARTS LIST

TITLE

REAR PANEL

ASSEMBLY NO.

1101-00-0669

REV

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PAGE: 2

REFERENCE DESIGNATORS

PART DESCRIPTION

ORIG-MFGR-PART-NO

MFGR

WAVETEK NO.

QTY/PT

NONE

TRANS

TIP-34

TI

4902-00-0340

1

NONE

TRANS

TIP-35

TI

4902-00-0350

1

NONE

SW ASSY SLIDE HI-LO

SW422-FT-HK

UID

5105-00-0001

1

NONE

SWITCH ASSY SLIDE

46256-LF

SWCFT

5105-00-0002

1

NONE

SOLDER GUARD

46256-LF-SG

SWCFT

5105-09-0001

2

NONE

VOLTAGE REGULATOR

7805393

FAIR

8000-78-0500

1

WAVETEK

PARTS LIST

TITLE

REAR PANEL

ASSEMBLY NO.

1101-00-0669

REV

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PAGE: 3

REMOVE ALL BURRS
AND BREAK SHARP EDGES

DRAWN

DATE

MATERIAL

PROJ ENGR

RELEASE APPROV

FINISH
WAVETEK PROCESS

TOLERANCE UNLESS
OTHERWISE SPECIFIED
XXX ±.010 ANGLES 11°
XX ±.030
DO NOT SCALE DWG
SCALE

MODEL NO
152

DWG NO
1101-00-0669

REV
A

CODE
IDENT 23338

SHEET 1 OF 1

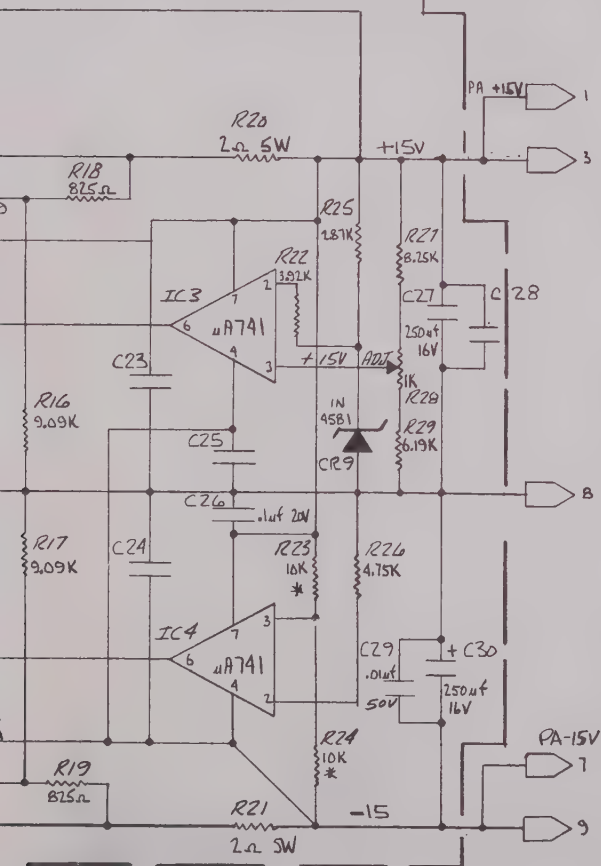
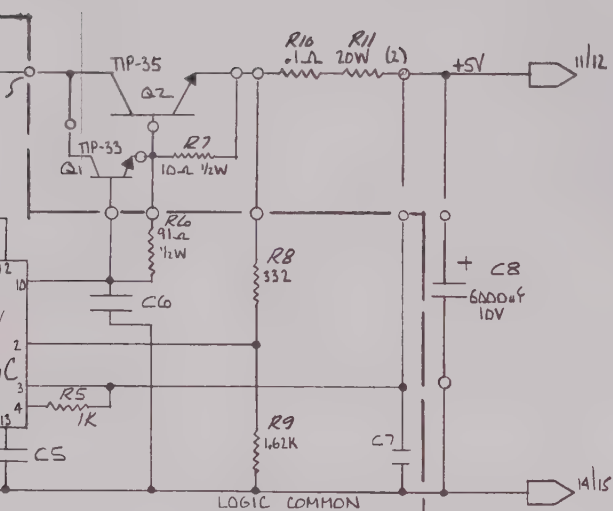
WAVETEK

SAN DIEGO • CALIFORNIA

TITLE

PWR SUPPLY ASSY

A

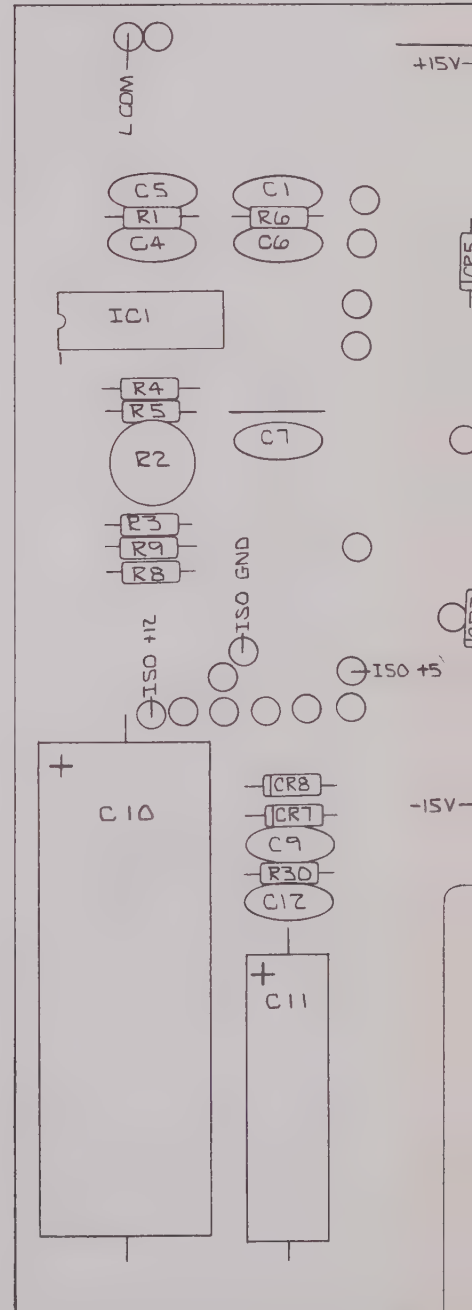


LAST REF DESIG USED

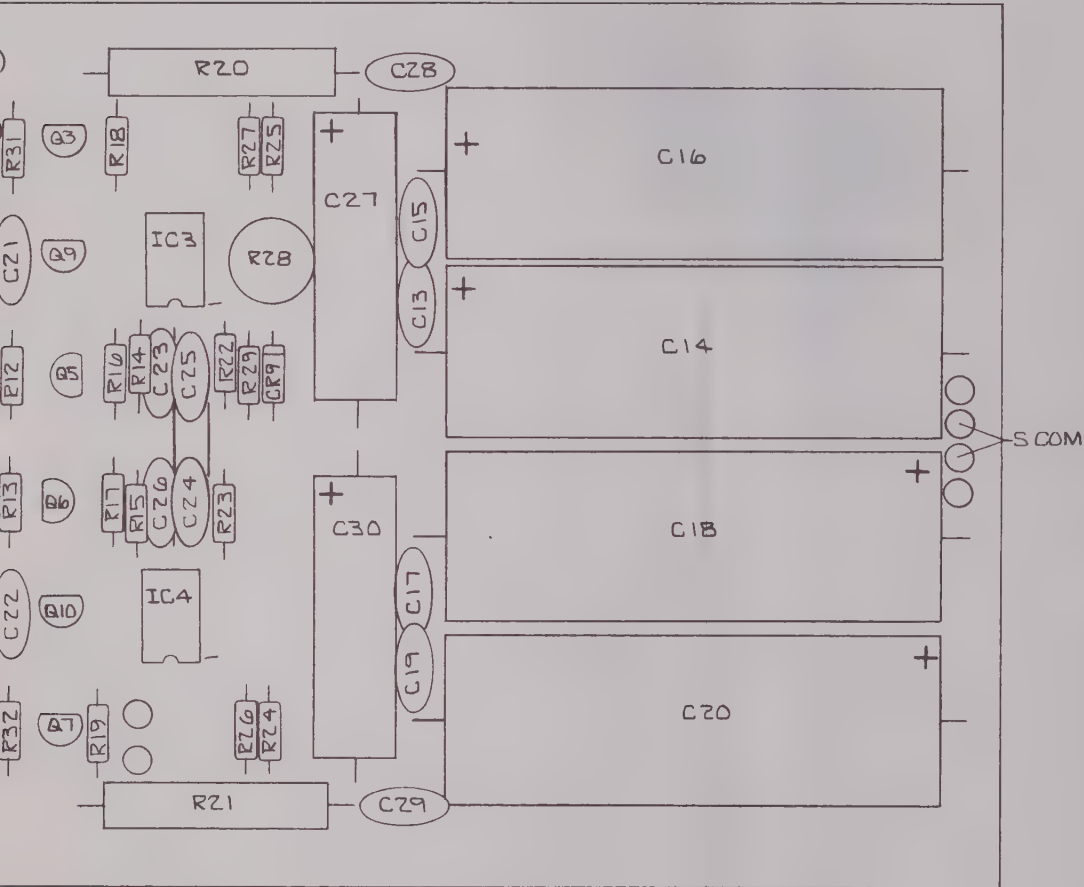
CAP	C30
DIODES	CR9
RES	R29
TRAN	Q10
INT CKT	IC4

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	 SAN DIEGO • CALIFORNIA	
	MATERIAL	PROJ/ENGR		
FINISH WAVETEK PROCESS	RELEASE APPROV	SCHEMATIC DIAGRAM POWER SUPPLY		
	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		MODEL NO.	DWG NO.
	DO NOT SCALE DWG		152	D152-236
SCALE	CODE IDENT		23338	SHEET 1 OF 1

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1. TERMINALS SHOULD BE USED FOR +15V & -15V CONNECTIONS
NOTE: UNLESS OTHERWISE SPECIFIED



REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN ADKINS	DATE 3-6-75	WAVETEK SAN DIEGO • CALIFORNIA TITLE ASSEMBLY POWER SUPPLY BD.		
	MATERIAL	PROJ ENGR			
FINISH WAVETEK PROCESS	RELEASE APPROV		MODEL NO. 152		
	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ± .010 ANGLES ± 1° .XX ± .030				
	DO NOT SCALE DWG				DWG NO. C152-036
	SCALE				REV A1
		CODE IDENT 23338	SHEET 1 OF		

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NOTE: UNLESS OTHERWISE SPECIFIED

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REV ECN BY DATE APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT	
NONE	CAP,CER,.01MF,50V	CK-103 LONG LEAD	CRL	1500-01-0300	6	
NONE	CAP,CER,.1MF,20V	UK20-104	ARCO	1500-01-0413	11	
NONE	CAP,CER,33PF,1KV	DD-330	CRL	1500-03-3011	2	
NONE	CAP,ELECT,1000MF,35V	39D108G035GL6	SPRAG	1500-31-0212	5	
NONE	CAP,ELECT,250MF,16V	500D257G016DF7	SPRAG	1500-32-5101	3	
NONE	POWER SUPPLY	152-136	WVTK	1700-00-0153	1	
NONE	TERM	1309D1	USECO	2100-05-0027	2	
NONE	POT,TRIM,1K	91AR1K	BECK	4600-01-0209	2	
NONE	RES,MF,1/8W,1%,100	RN55D-1000F	TRW	4701-03-1000	1	
NONE	RES,MF,1/8W,1%,1K	RN55D-1001F	TRW	4701-03-1001	1	
NONE	RES,MF,1/8W,1%,10K	RN55D-1002F	TRW	4701-03-1002	2	
NONE	RES,MF,1/8W,1%,1.5K	RN55D-1501F	TRW	4701-03-1501	1	
NONE	RES,MF,1/8W,1%,1.62K	RN55D-1621F	TRW	4701-03-1621	1	
NONE	RES,MF,1/8W,1%,2.21K	RN55D-2211F	TRW	4701-03-2211	2	
NONE	RES,MF,1/8W,1%,2.87K	RN55D-2871F	TRW	4701-03-2871	1	
NONE	RES,MF,1/8W,1%,332	RN55D-3320F	TRW	4701-03-3320	1	
NONE	RES,MF,1/8W,1%,3.63K	RN55D-3631F	TRW	4701-03-3631	1	
NONE	RES,MF,1/8W,1%,3.92K	RN55D-3921F	TRW	4701-03-3921	1	
WAVETEK PARTS LIST		TITLE PCA POWER SUPPLY			ASSEMBLY NO. 1100-00-0153 PAGE: 1	REV

SDS-B BUSINESS FORMS PRINTING, INC. 2187

D

C

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	RES,MF,1/8W,1%,464	RN55D-4640F	TRW	4701-03-4640	2
NONE	RES,MF,1/8W,1%,4.75K	RN55D-4751F	-TRW	4701-03-4751	3
NONE	RES,MF,1/8,1%,499	RN55D-4990F	TRW	4701-03-4990	1
NONE	RES,MF,1/8W,1%,6.19K	RN55D-6191F	TRW	4701-03-6191	1
NONE	RES,MF,1/8W,1%,825	RN55D-8250F	TRW	4701-03-8250	2
NONE	RES,MF,1/8W,1%,8.25K	RN55D-8251F	TRW	4701-03-8251	1
NONE	RES,MF,1/8W,1%,9.09K	RN55D-9091F	TRW	4701-03-9091	2
NONE	RES,MF,1/8W,1%,90.9	RN55D-9099F	TRW	4701-03-9099	1
NONE	RES,MW,5W,5%,2	243E2R05	SPRAG	4702-65-2009	2
NONE	DIODE	1N4581	MICRO	4801-01-4581	1
NONE	DIODE	8CE-1	SEMTC	4801-02-0001	6
NONE	TRANS	2N3638	FAIR	4901-03-6380	3
NONE	TRANS	2N3642	FAIR	4901-03-6420	3
NONE	IC	723PC	FAIR	7000-07-2300	1
NONE	IC	MA-741	FAIR	7000-07-4100	2
WAVETEK PARTS LIST		TITLE PCA POWER SUPPLY		ASSEMBLY NO. 1100-00-0153 PAGE: 2	
					REV

SDS-B BUSINESS FORMS PRINTING, INC. 2187

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REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA	
MATERIAL	PROJ ENGR		TITLE PWR SUPPLY BD	
	RELEASE APPROV			
	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030			
FINISH WAVETEK PROCESS	DO NOT SCALE DWG	MODEL NO. 152	DWG NO. 1100-00-0153	REV
	SCALE	CODE IDENT 23338	SHEET 1	OF 1

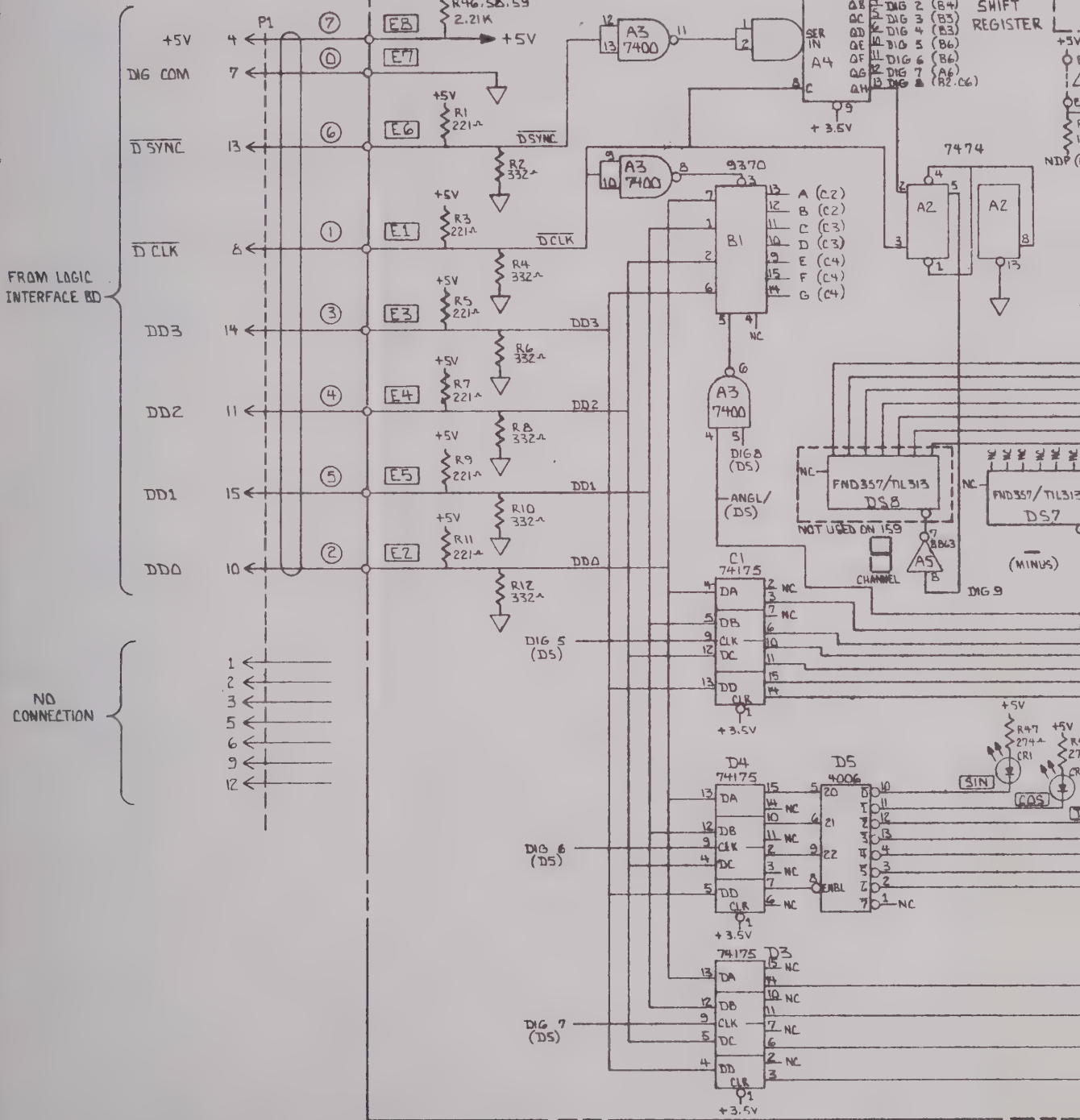
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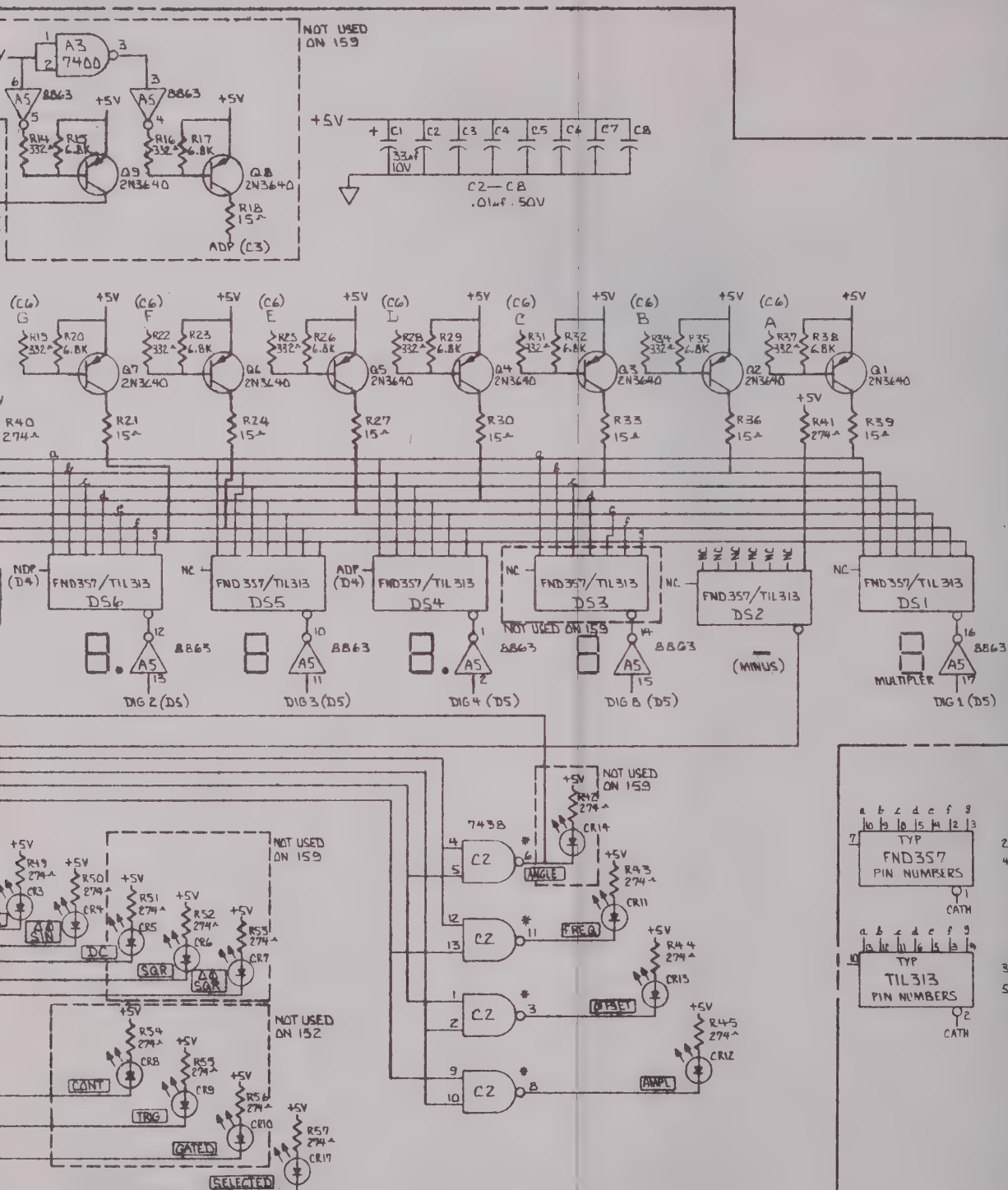
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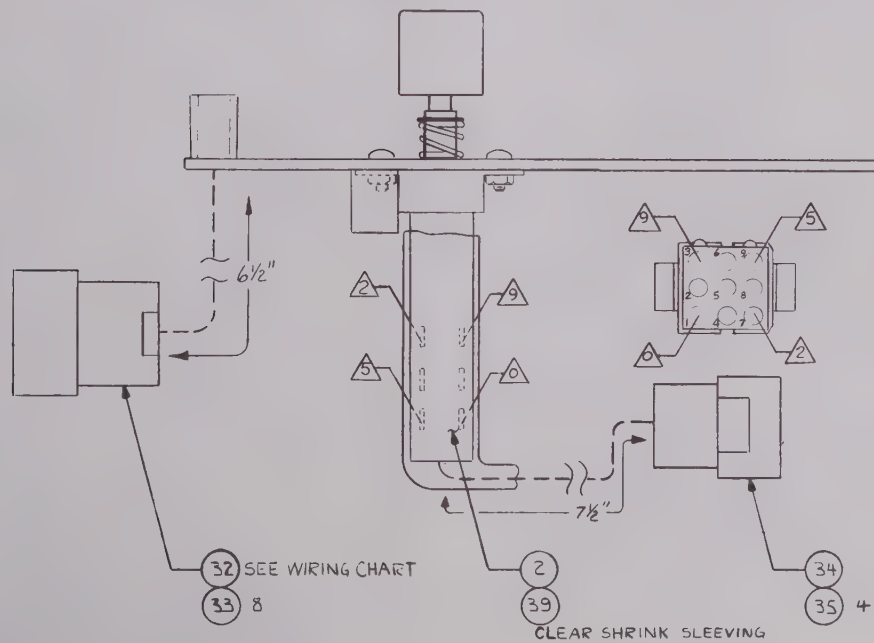
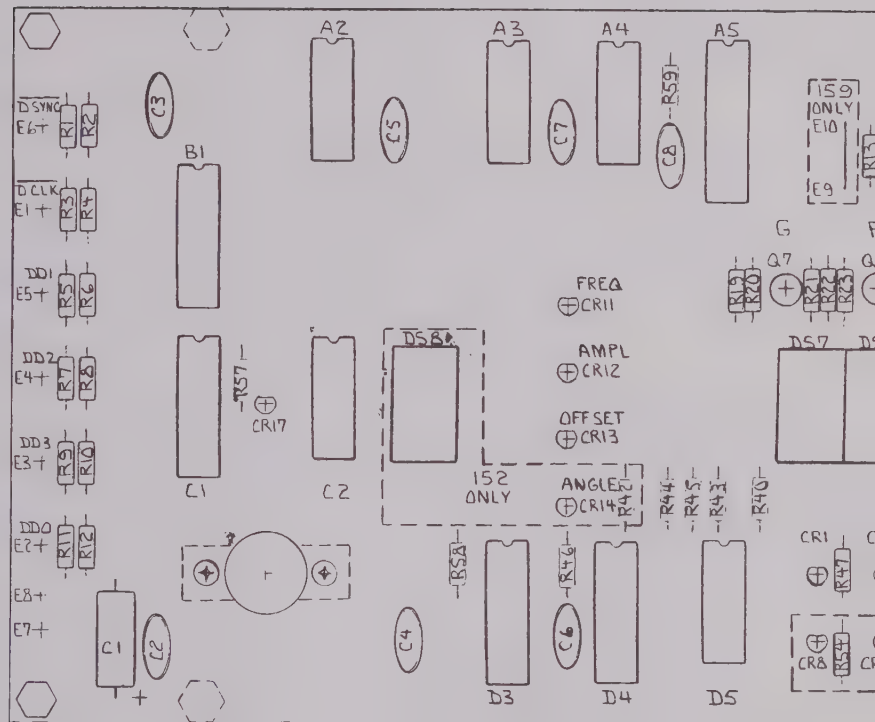
1. ○ DENOTES WIRE COLOR PER COLOR CODE.
2. □ DENOTES LABELING ON BOARD OR DISPLAY PANEL.
3. ALL RESISTORS ARE $\pm 1\%$ $\frac{1}{10}W$.
- △ ADD JUMPER WHEN LOADING FOR MODEL 159.

NOTE: UNLESS OTHERWISE SPECIFIED

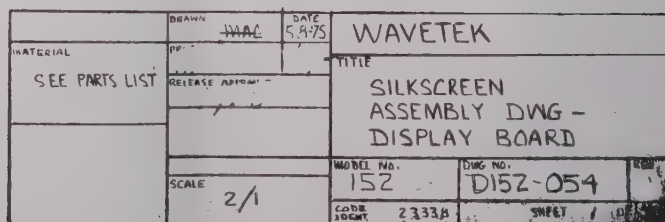


REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN <i>WWE</i>	DATE 4-3-75	WAVETEK SAN DIEGO • CALIFORNIA	
MATERIAL			TITLE SCHEMATIC - ~~WAVE~~ BOARD	
	TOLERANCE UNLESS OTHERWISE SPECIFIED XX.X ± .010 ANGLES 1° .XX ± .005			
FINISH WAVETEK PROCESS	DO NOT SCALE DIMS			
	SCALE		15Z	DESK NO. DISC-254
			23338	SHEET OF

WIRING CHART		
BOARD LOCATION	CODED WIRE COLOR	CONNECTOR PIN NUMBER
E1	1	8
E2	2	10
E3	3	14
E4	4	11
E5	5	15
E6	6	13
E7	0	7
E8	7	4



NOTES: 1. Δ DENOTES WIRE COLOR PER COLOR CODE.



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NOTE: UNLESS OTHERWISE SPECIFIED

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REV

ECN

BY

DATE

APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	CAP,CER,.01MF,50V	CK-103	CRL	1500-01-0310	7
NONE	CAP,TANT,33MF,10V	150D336X901082	SPRAG	1500-73-3601	1
NONE	DISPLAY	158-151	WVTK	1700-00-0105	1
NONE	PLUG,9PIN	03-06-2091	MOLEX	2100-02-0011	1
NONE	PLUG,15PIN	03-09-2151	MOLEX	2100-02-0013	1
NONE	PIN,MALE	02-06-2103	MOLEX	2100-05-0003	4
NONE	PIN,MALE	02-09-2118	MOLEX	2100-05-0005	8
NONE	STANDOFF	6910-6-2C	LYNTR	2800-03-0002	8
NONE	RES,MF,1/8W,1%,15	RN550-15R0F	TRW	4701-03-1509	9
NONE	RES,MF,1/8W,1%,221	RN550-2210F	TRW	4701-03-2210	6
NONE	RES,MF,1/8W,1%,2.21K	RN550-2211F	TRW	4701-03-2211	3
NONE	RES,MF,1/8W,1%,274	RN550-2740F	TRW	4701-03-2740	14
NONE	RES,MF,1/8W,1%,332	RN550-3320F	TRW	4701-03-3320	15
NONE	RES,MF,1/8W,1%,6.81K	RN550-6811F	TRW	4701-03-6811	9
NONE	LED	T1L-209A	TI	4899-00-0005	12
NONE	LED	5082-7740-C	HP	4899-00-0009	8
NONE	TRANS	2N3640	FAIR	4901-03-6400	9
NONE	SWITCH ASSY PB	157-422	WVTK	5103-00-0011	1

WAVETEK
PARTS LIST

TITLE
DISPLAY

ASSEMBLY NO.
1100-00-0149
PAGE: 1

REV

REV

ECN

BY

DATE

APP

4

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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	BUTTON	8315 BLACK	CRL	5103-04-0001	1
NONE	IC	4006	MDT	8000-40-0600	1
NONE	IC	7400	TI	8000-74-0000	1
NONE	IC	7438	TI	8000-74-3800	1
NONE	IC	7474	TI	8000-74-7400	1
NONE	IC	DS8863	NSC	8000-88-6300	1
NONE	IC	9370DC	FAIR	8000-93-7000	1
NONE	IC	74164	TI	8007-41-6400	1
NONE	IC	74175	TI	8007-41-7500	3

WAVETEK
PARTS LIST

TITLE
DISPLAY

ASSEMBLY NO.
1100-00-0149
PAGE: 2

REV

REV

ECN

BY

DATE

APP

4

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REMOVE ALL BURRS
AND BREAK SHARP EDGES

DRAWN

DATE

MATERIAL

PROJ ENGR

RELEASE APPROV

FINISH
WAVETEK PROCESS

TOLERANCE UNLESS
OTHERWISE SPECIFIED
.XXX ±.010 ANGLES :1°
.XX ±.030

DO NOT SCALE DWG

SCALE

WAVETEK
SAN DIEGO • CALIFORNIA

TITLE
DISPLAY BD

MODEL NO.
152

DWG NO.
1100-00-0149

REV

CODE
IDENT 23338

SHEET 1 OF 1

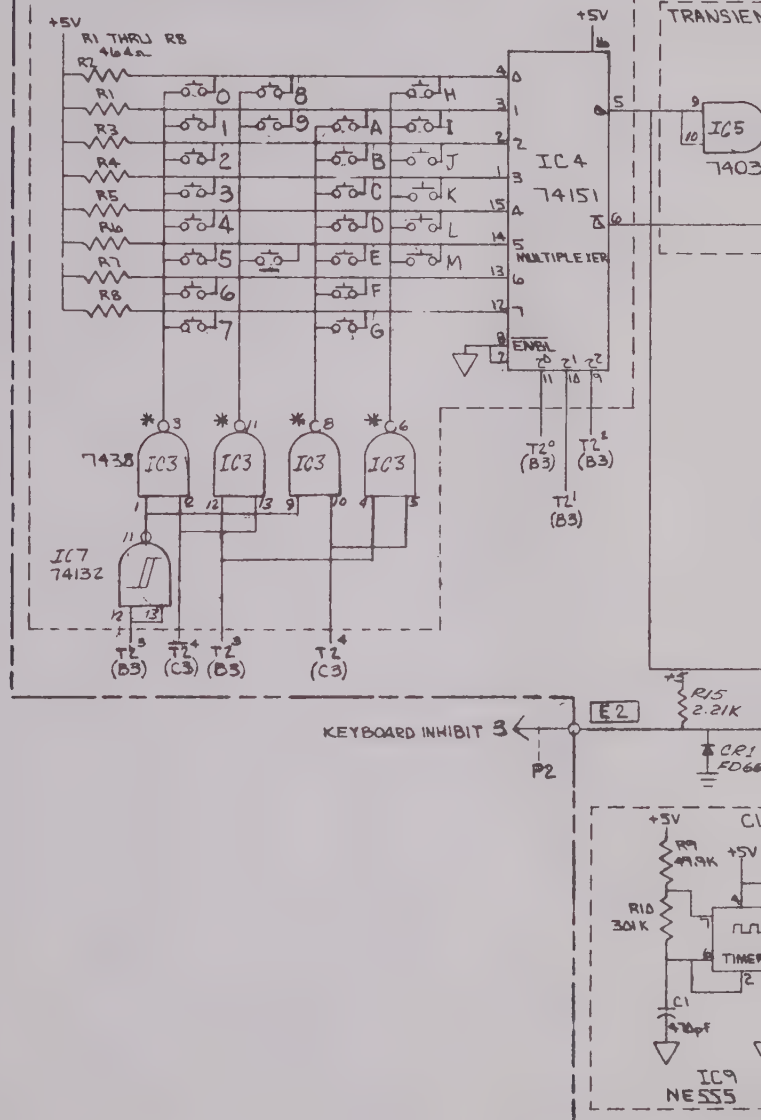
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KEYBOARD ARRANGEMENT

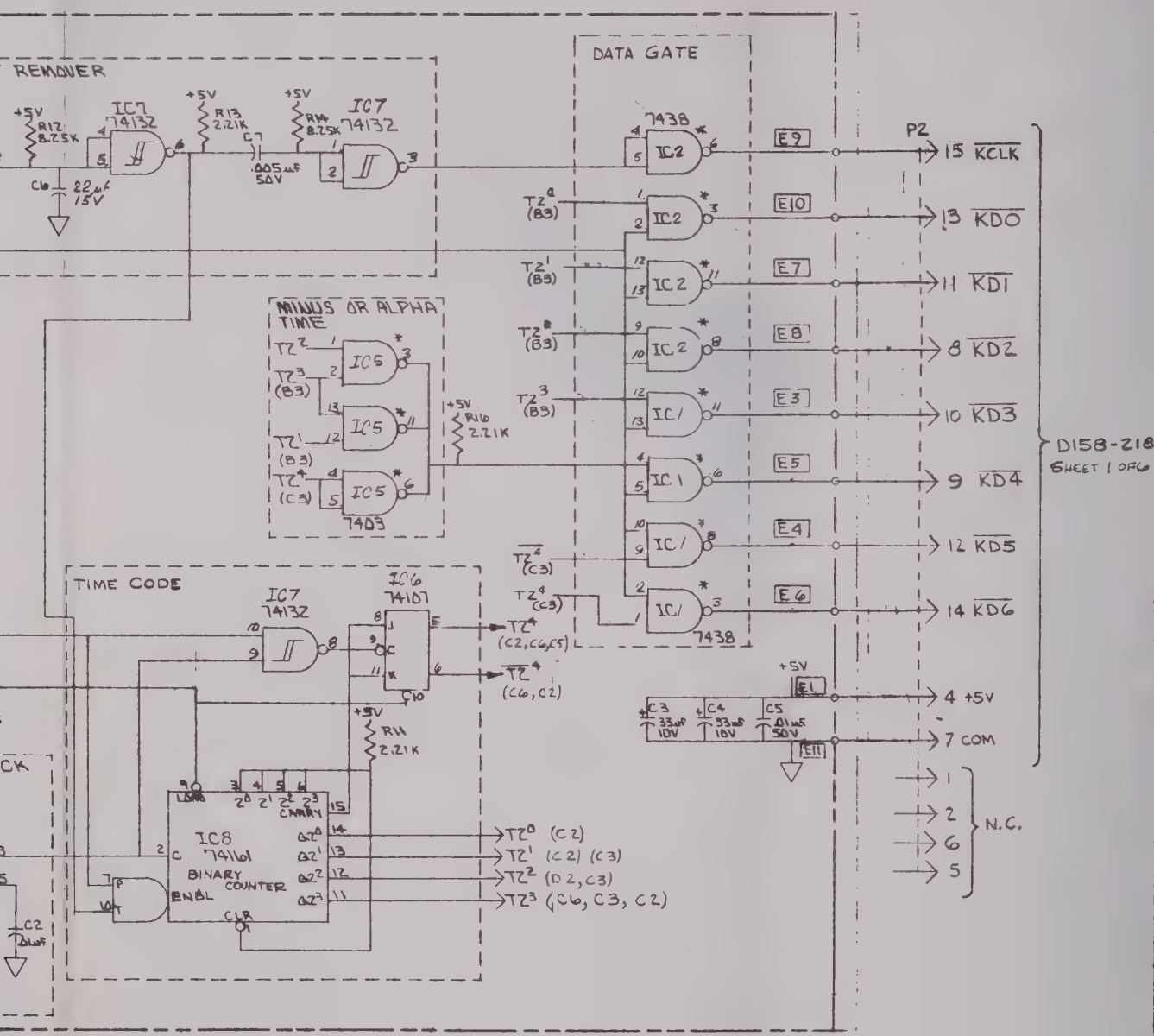
7	8	9	A	G
4	5	6	D	B
1	2	3	C	F
-	0	E	H	I

A = FREQ
B = FUNC
C = OFST
D = AMPL
E = MULT
F = CHNL
G = UNIT
H = EXEC
I = ANGL

KEYBOARD AND MULTIPLEXING



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○ DENOTES WIRE COLORS PER RESISTOR COLOR CODES.
 □ DENOTES ACTUAL LABELING.
 BAR OVER MNEMONIC DENOTES TRUE-WHEN-LOW.
 * DENOTES OPEN COLLECTOR.
 ALL RESISTORS ARE 1% 1/4W.
 NOTE: UNLESS OTHERWISE SPECIFIED.

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK	
MATERIAL			TITLE	
FINISH	TOLERANCE UNLESS OTHERWISE SPECIFIED		SCHEMATIC KEY BOARD A6	
WAVETEK PROCESS	XXX .010 ANGLES .1			
	DO NOT SCALE DWG		MODEL NO.	DWG NO.
SCALE			152	D152-256
			23338	SHEET

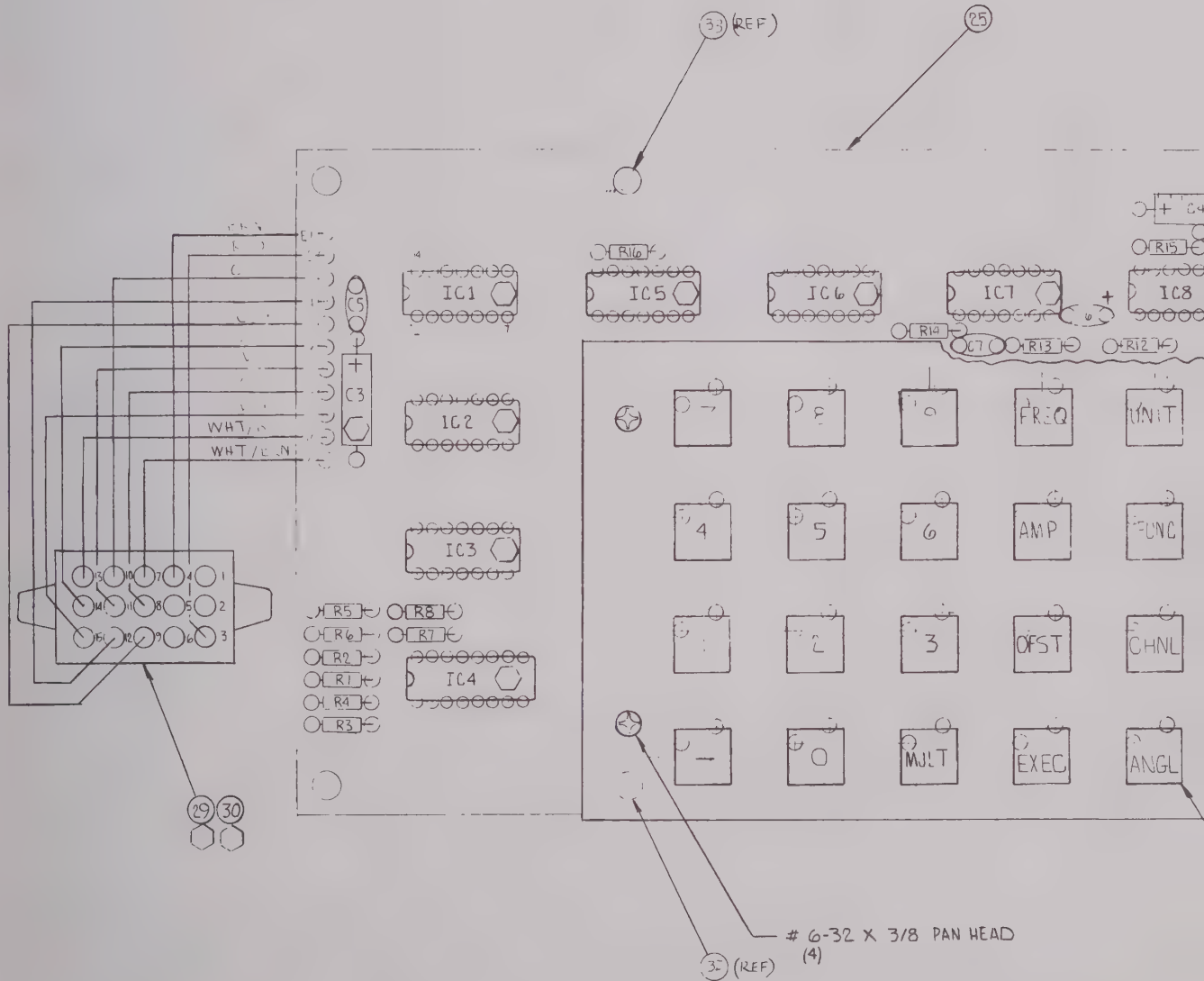
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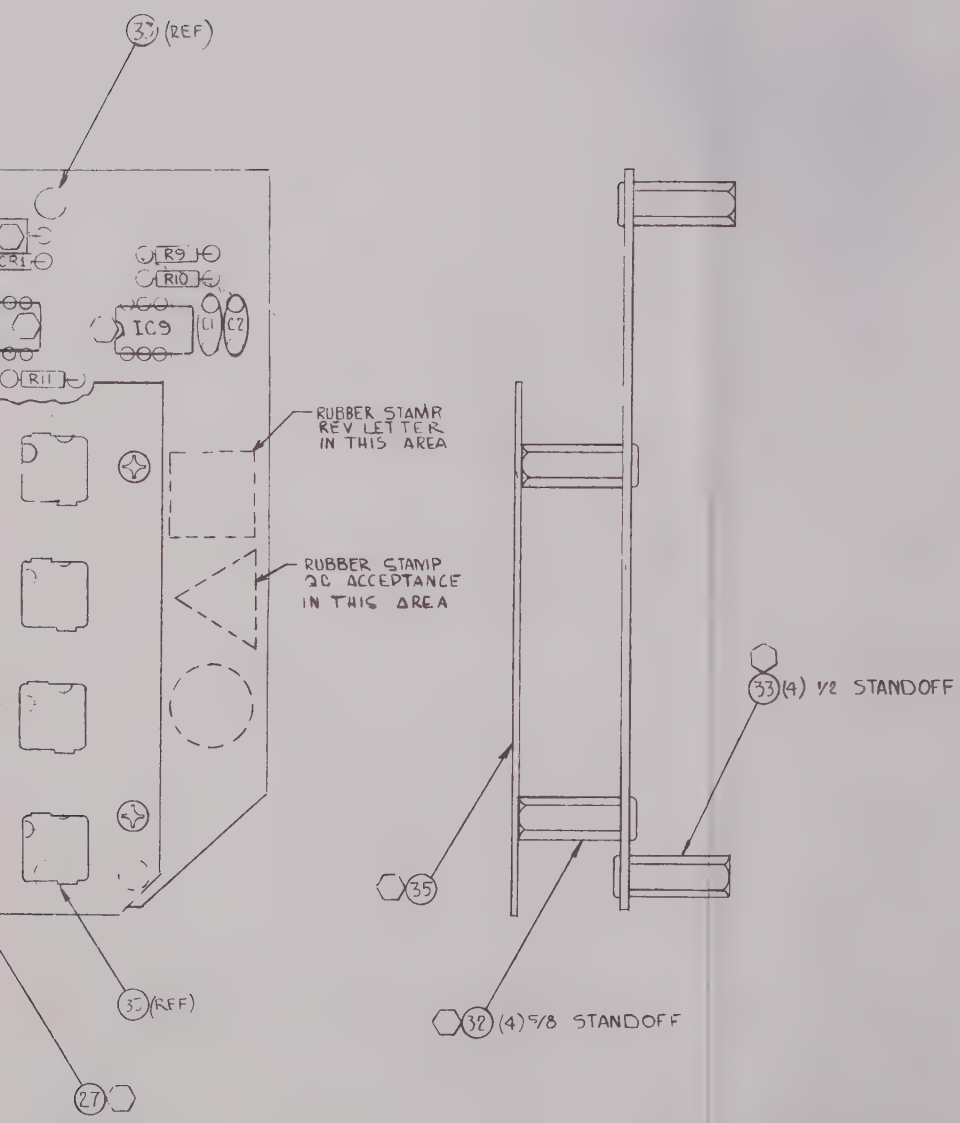
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REMOVE ALL BURRS AND BREAK SHARP EDGES		DRAWN D. BARNETT	DATE 12/1/74	WAVETEK SAN DIEGO • CALIFORNIA	
MATERIAL		RELEASE		TITLE PC ASSY- KEY BOARD	
		TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES .1 XX .030			
		DO NOT SCALE DWG			
FINISH WAVETEK PROCESS		SCALE 2/1		MODEL NO 152	DWG NO D152-056
		CODE IDENT 23338		SHEET /	

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REFERENCE DESIGNATORS	PART DESCRIPTION	QTY
NONE	CAP, CER, KEY	158-300
NONE	CAP, CER, .01MF, 50V	CA-103-1000
NONE	CER, CER, .01MF, 1KV	CC-407
NONE	CAP, CER, .015MF, 50V	CA-502
NONE	CAP, TANT, 22MF, 15V	19602261901
NONE	CAP, TANT, 53MF, 10V	15103361901
NONE	KEY BOARD	158-147
NONE	PLUG, 15PIN	153-04-2151
NONE	PCB, MALE	12-09-2118
NONE	STANDOFF	15318-5/8
NONE	RES, MF, 1/8W, 1%, 2.21K	RN550-2211P
NONE	RES, MF, 1/8W, 1%, 301K	RN550-3013P
NONE	RES, MF, 1/8W, 1%, 464	RN550-4640P
NONE	RES, MF, 1/8W, 1%, 4.7K	RN550-4742P
NONE	RES, MF, 1/8W, 1%, 5.25K	RN550-5251P
NONE	00000	F-10000
NONE	SWITCH, AND	Me1-0100
NONE	KEY, 11P, 12400	154-122

WAVETEK
PARTS LIST

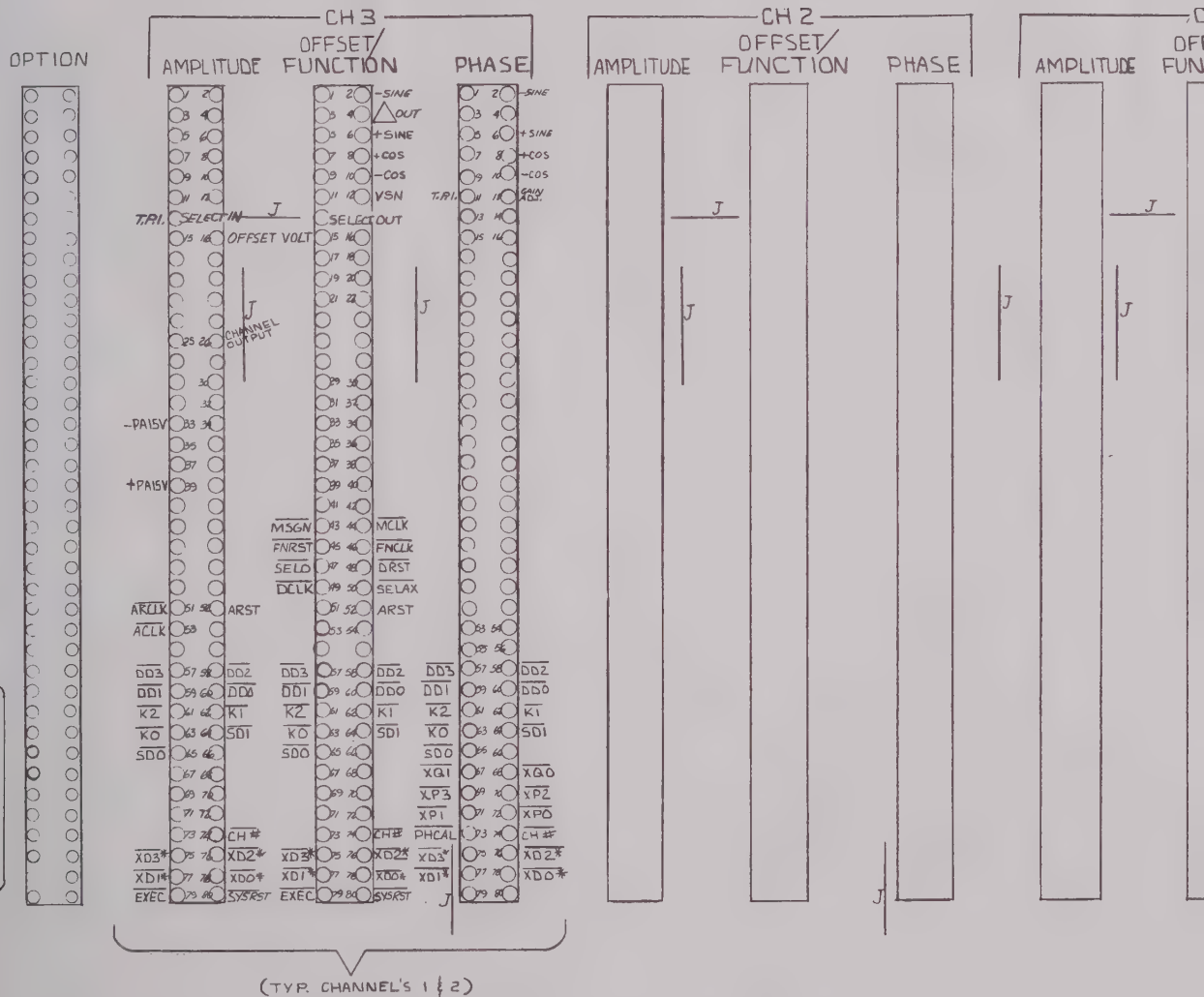
TITLE
PCB KEYBOARD

EXTENDER CARD 152-131
STD. INST.

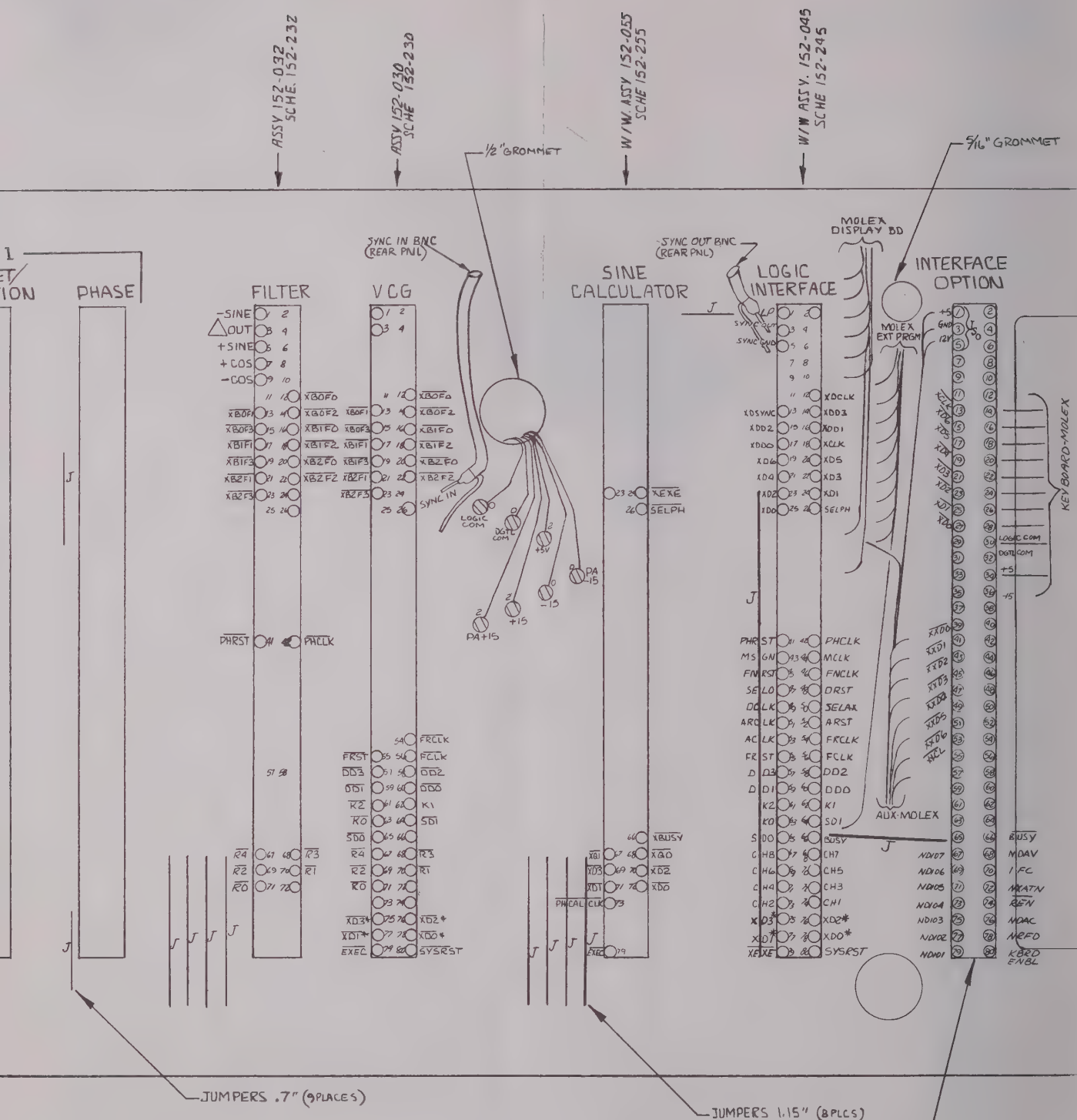
ASSY 152-028
SCHE. 152-228

ASSY 152-027
SCHE. 152-227

ASSY 152-026
SCHE. 152-226



4. ROUTE ALL LABELING TO BRODGE, UNDER CONN. MTG HOLES.
 3. ASSY IEC, ISO, TTY/RS232 OPTION BD, NOT INSTALLED ON STD. MACH..
 2. CONN.'S ARE CINCH JONES, 80 PIN CARD CONN., #HW4000. (15 PLCS)
- NOTES: 1. ASSY. CALLOUTS FOR REF. ONLY.



COMPONENT SIDE

WAVETEK
ASSY. MOTHER BD
MODEL 152 STANDARD
D152-034 A

1 of 2

Re 3-16-76

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NOTE. UNLESS OTHERWISE SPECIFIED

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REV ECN BY DATE APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFG-PART-NO	MFG	WAVETEK NO.	QTY/P1
NONE	BLOCK,CABLE MTG	152-328	WVTK	1400-00-A640	5
NONE	MOTHER BOARD	152-134	WVTK	1700-00-0670	1
NONE	CONN,15PIN	03-09-1151	MOLEX	2100-02-0012	4
NONE	PLUG,15PIN	03-09-2151	MOLEX	2100-02-0013	1
NONE	CONN	57-20240	AMPH	2100-02-0060	1
NONE	CONN,EDGE,80 PIN	2HWH000-111	WINCH	2100-03-0054	15
NONE	PIN,MALE	02-09-2118	MOLEX	2100-05-0005	15
NONE	PIN,FEMALE	02-09-1118	MOLEX	2100-05-0026	60
NONE	TERM	1309A1	USECO	2100-05-0046	10
NONE	CABLE CLAMP	835	SMITH	2800-00-0010	3
NONE	CLAMP,CABLE	837	SMITH	2800-00-0011	2
NONE	RETAINER,SPRING	D-191	WEKSP	2800-09-0007	3
NONE	GROMMET	GP2172/3068	ROYAL	2800-10-0001	1
NONE	GROMMET,RUBBER	2175	SMITH	2800-10-0003	2
WAVETEK PARTS LIST		TITLE PCA MOTHER BD	ASSEMBLY NO. 1100-00-0670 PAGE: 1		REV C

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA	
MATERIAL	PROJ ENGR		TITLE PARTS LIST	
	RELEASE APPROV			
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° XX ±.030			
	DO NOT SCALE DWG	MODEL NO 152	DWG NO 1100-00-0670	REV C
SCALE		CODE IDENT 23338	SHEET 1	OF 1

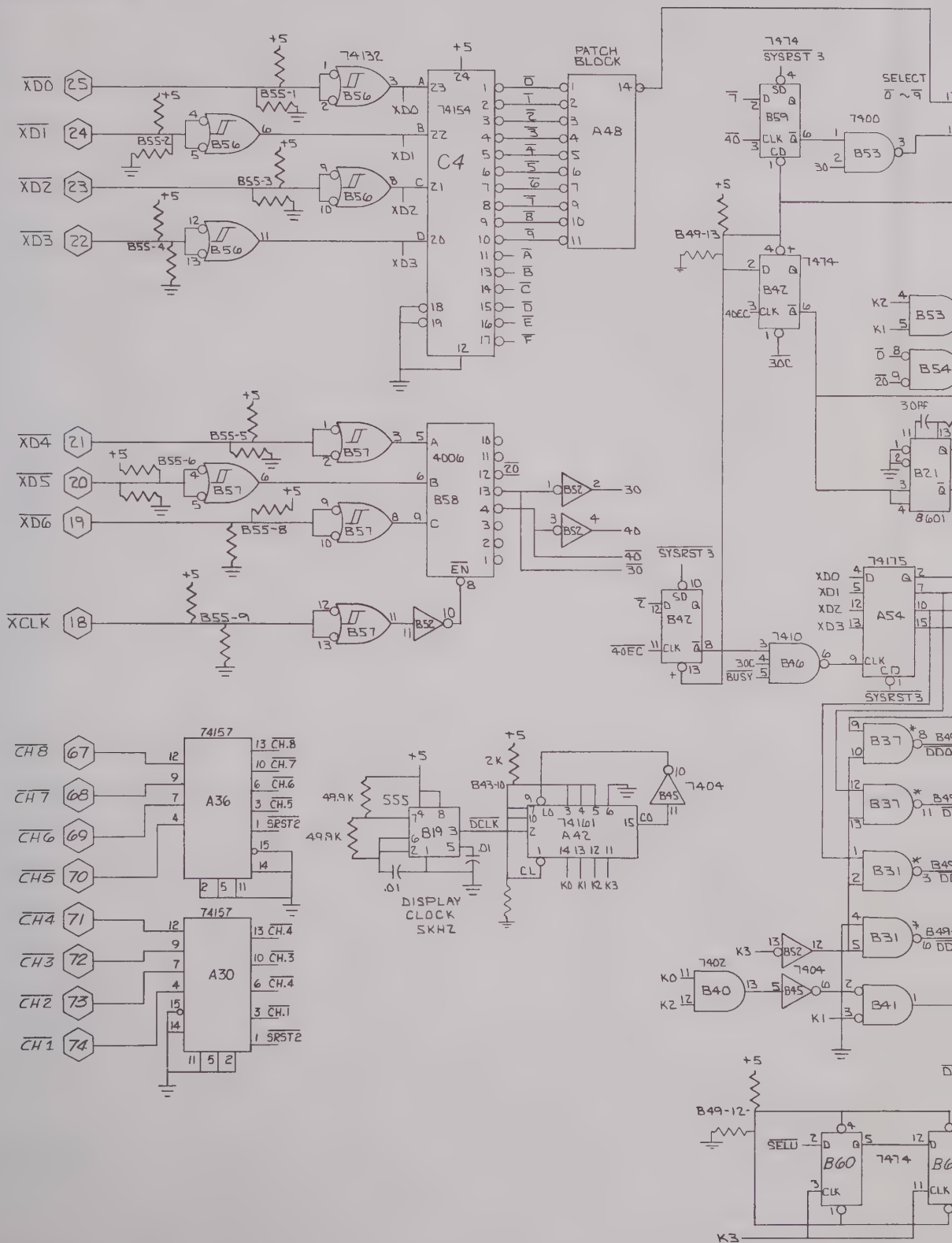
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NOTE: UNLESS OTHERWISE SPECIFIED

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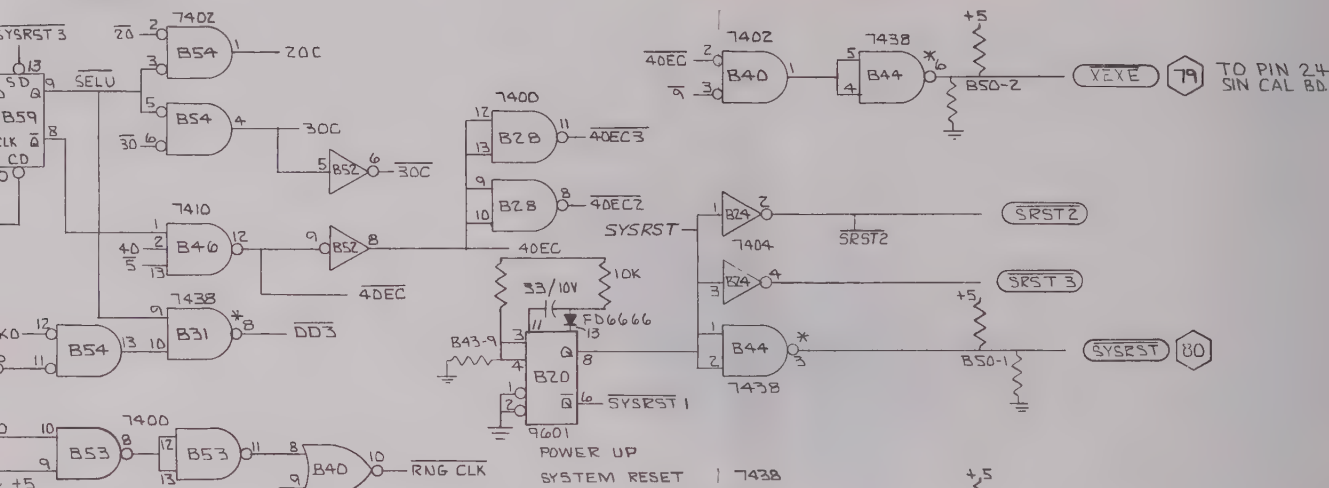
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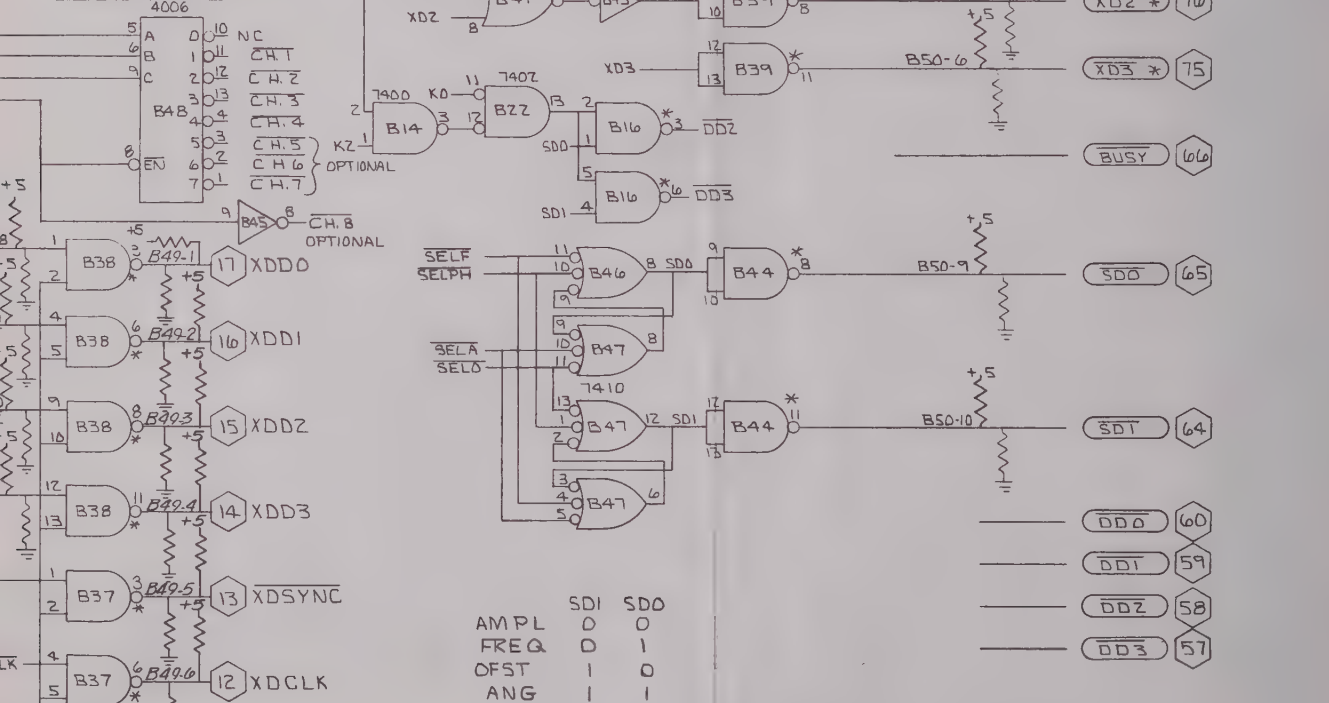
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REV	ECN	BY	DATE	APP
B	SEE ECN #1805	DC	9-18-80	
C	ECN #2170	LTE	5-21-80	

UNIT SELECT

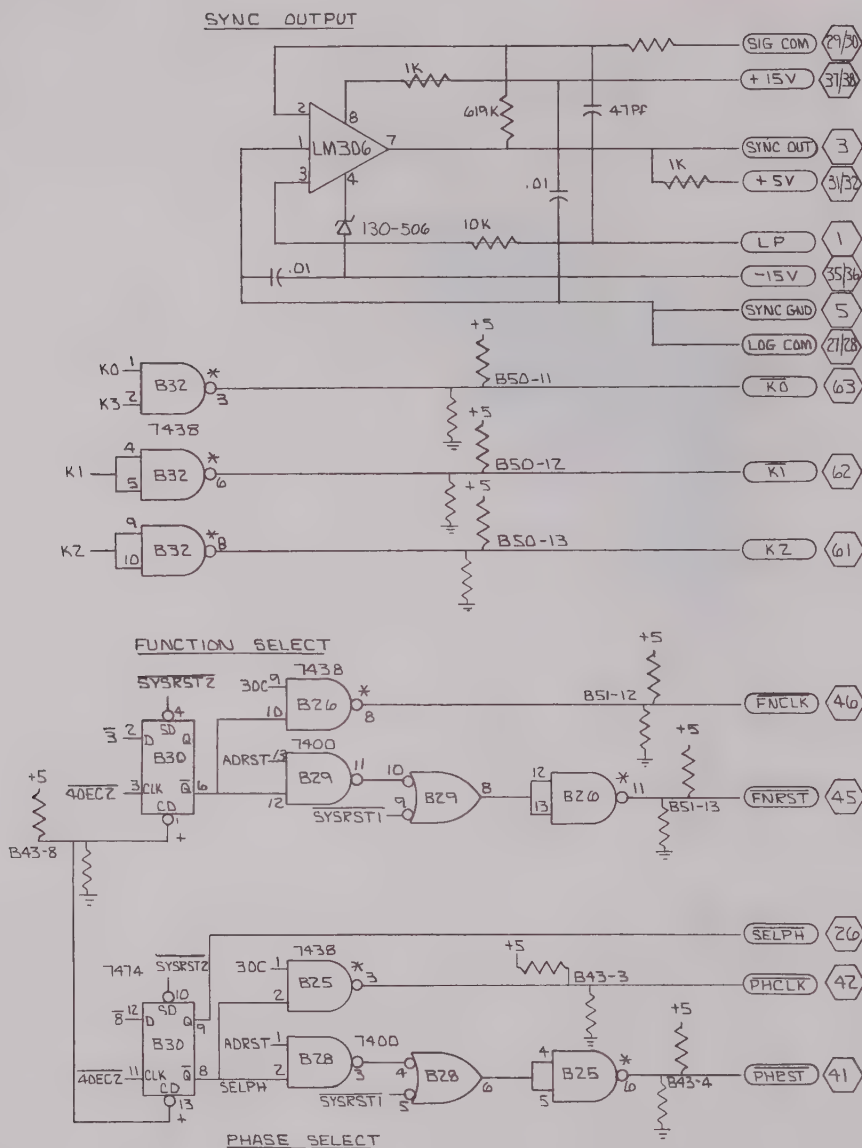


CHANNEL SELECT



SDI SD0
AMPL 0 0
FREQ 0 1
OFST 1 0
ANG 1 1

REMOVE ALL BURRS AND BREAK SHARP EDGES		DRAWN ADKINS		DATE 3-24-85		WAVETEK SAN DIEGO • CALIFORNIA	
MATERIAL		PROJ ENGR		TITLE		SCHEMATIC LOGIC INTERFACE	
FINISH WAVETEK PROCESS		RELEASE APPROV		TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ± 0.10 ANGLES ± 1° .XX ± 0.30		MODEL NO 152	
SCALE		DO NOT SCALE DWG		DWG NO D152-245		REV C	
CODE IDENT		23338		SHEET 1		OF 2	



REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN ADKINS	DATE 3-25-75	WAVETEK SAN DIEGO • CALIFORNIA
MATERIAL	PROJ ENGR		
FINISH WAVETEK PROCESS	RELEASE APPROV		TITLE SCHEMATIC LOGIC INTERFACE
	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX .010 ANGLES .1"		MODEL NO. 152
	DO NOT SCALE DWG		DWG NO. D152-245
SCALE			REV C
			CODE IDENT 23338
			SHEET 2 OF 2

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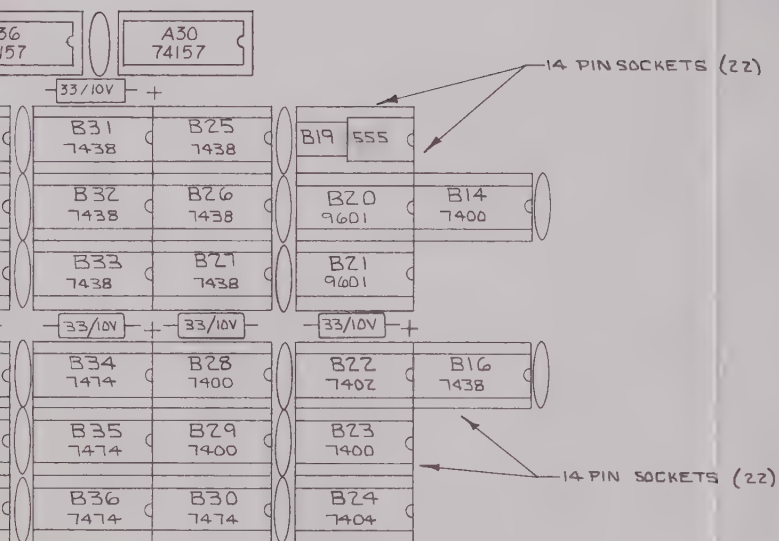
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REV	ECN	BY	DATE	APP
C	ECN #2170	WTE	5-21-81	

TS (3)



REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN SA	DATE 3/1/81	WAVETEK SAN DIEGO • CALIFORNIA	
MATERIAL	PROJ ENGR	RELEASE APPROV	TITLE ASSEMBLY LOGIC INTERFACE	
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° XX ±.030		DO NOT SCALE DWG	
SCALE		MODEL NO 152	DWG NO DISZ-045	REV C
CODE IDENT		23338	SHEET 1	OF

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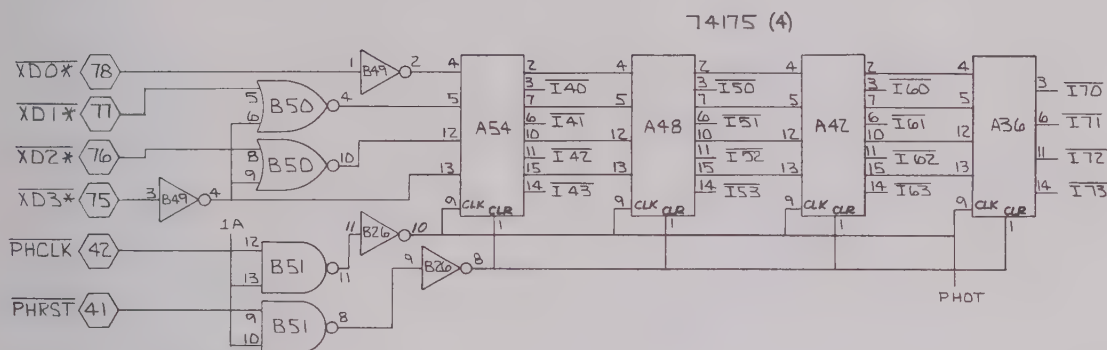
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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFR-PART-NO
NONE	BLOCK,CABLE MTG	152-32A
NONE	MOTHER BOARD	152-134
NONE	CONN,15PIN	03-09-1151
NONE	PLUG,15PIN	03-09-2151
NONE	CONN	57-20240
NONE	CONN,EDGE,80 PIN	2HW4000-111
NONE	PIN,MALE	02-09-2118
NONE	PIN,FEMALE	02-09-1118
NONE	TERM	1309R1
NONE	CABLE CLAMP	835
NONE	CLAMP,CAHLE	837
NONE	RETAINER,SPRING	D-191
NONE	GROMMET	GB2172/3068
NONE	GROMMET,RUBBER	2175
WAVETEK PARTS LIST		TITLE PCA MOTHER BD ASSEMBLY 1100-0 PAGE 1

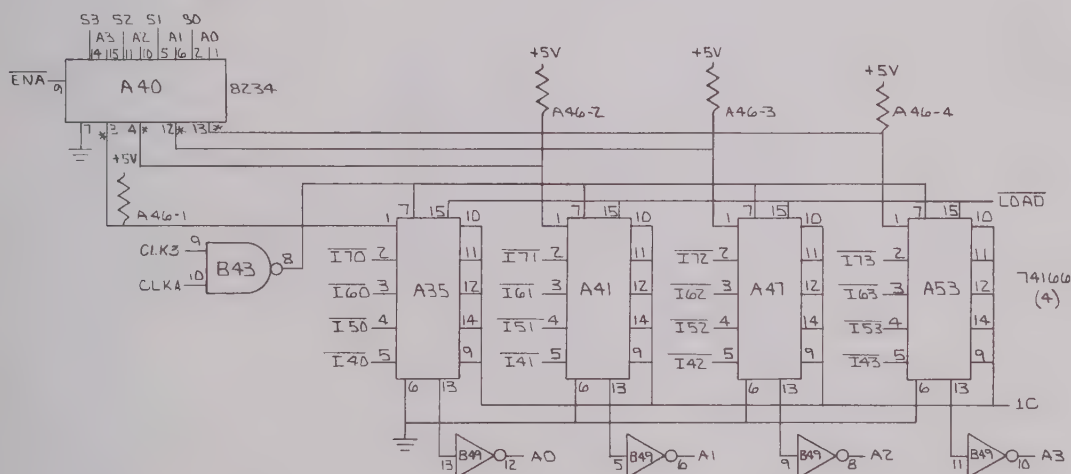
REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFR-PART-NO
NONE	CAP,CER,.01MF,50V	CK-103 LONG LEAD
NONE	CAP,CER,.1MF,10V	UK10-104
NONE	CAP,CER,33PF,1KV	DD-330
NONE	CAP,CER,47PF,1KV	DD-470 LONG LEAD
NONE	CAP,ELECT,250MF,16V	500D257G016DF7
NONE	CAP,TANT,33MF,10V	150D336X9010B2
NONE	SINE CALCULATOR	152-122
NONE	ADAPTER PLUG 14 PIN	6144-14
NONE	SKT,IC,14PIN,WW	CSA2200-14BC
NONE	SKT,IC,16PIN,WW	CSA2200-16BC
NONE	SKT,IC,12PIN,WW	CSA2300-12BC
NONE	CONN PIN,MALE (UOM-EA PIN)	CA-836SP-100-230-
NONE	RES,MF,1/8W,1%,1K	RN55D-1001F
NONE	RES,MF,1/8W,1%,10K	RN55D-1002F
NONE	RES,MF,1/8W,1%,49,9K	RN55D-4992F
NONE	RES,MF,1/4W,1%,619K	RN60D-6193F
NONE	RES MODULE	899-5-R220/330
WAVETEK PARTS LIST		TITLE PCA,LOGIC INTERFACE ASSEMBLY 1100-0 PAGE 1

4			3			2			1		
						REV	ECN		BY	DATE	APP

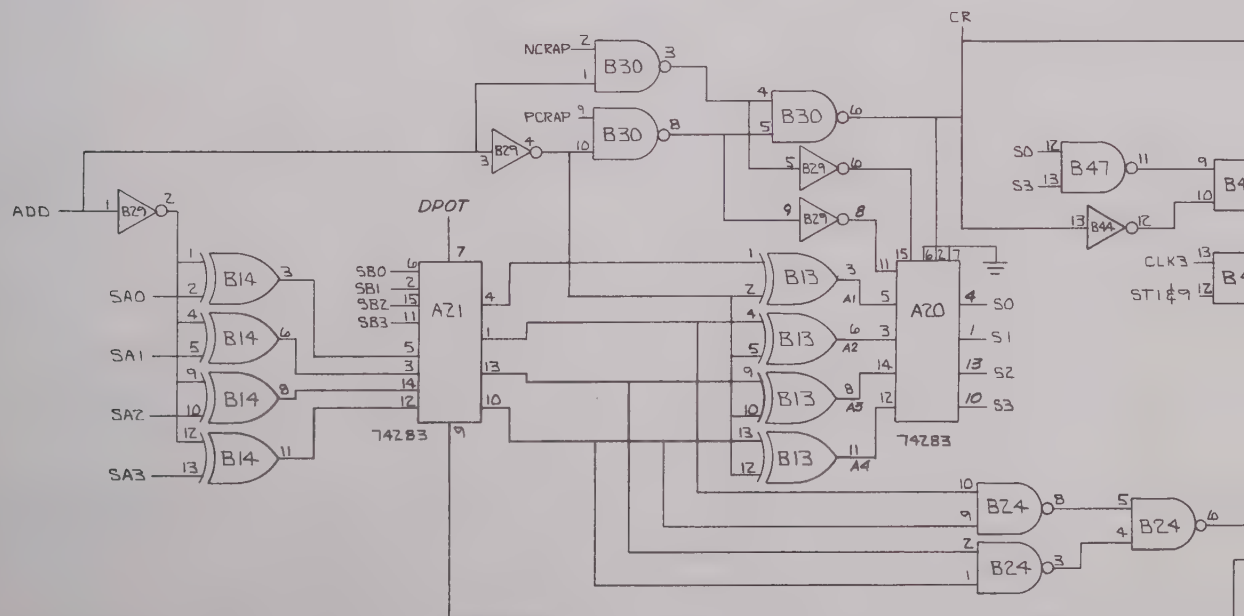
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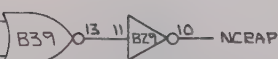
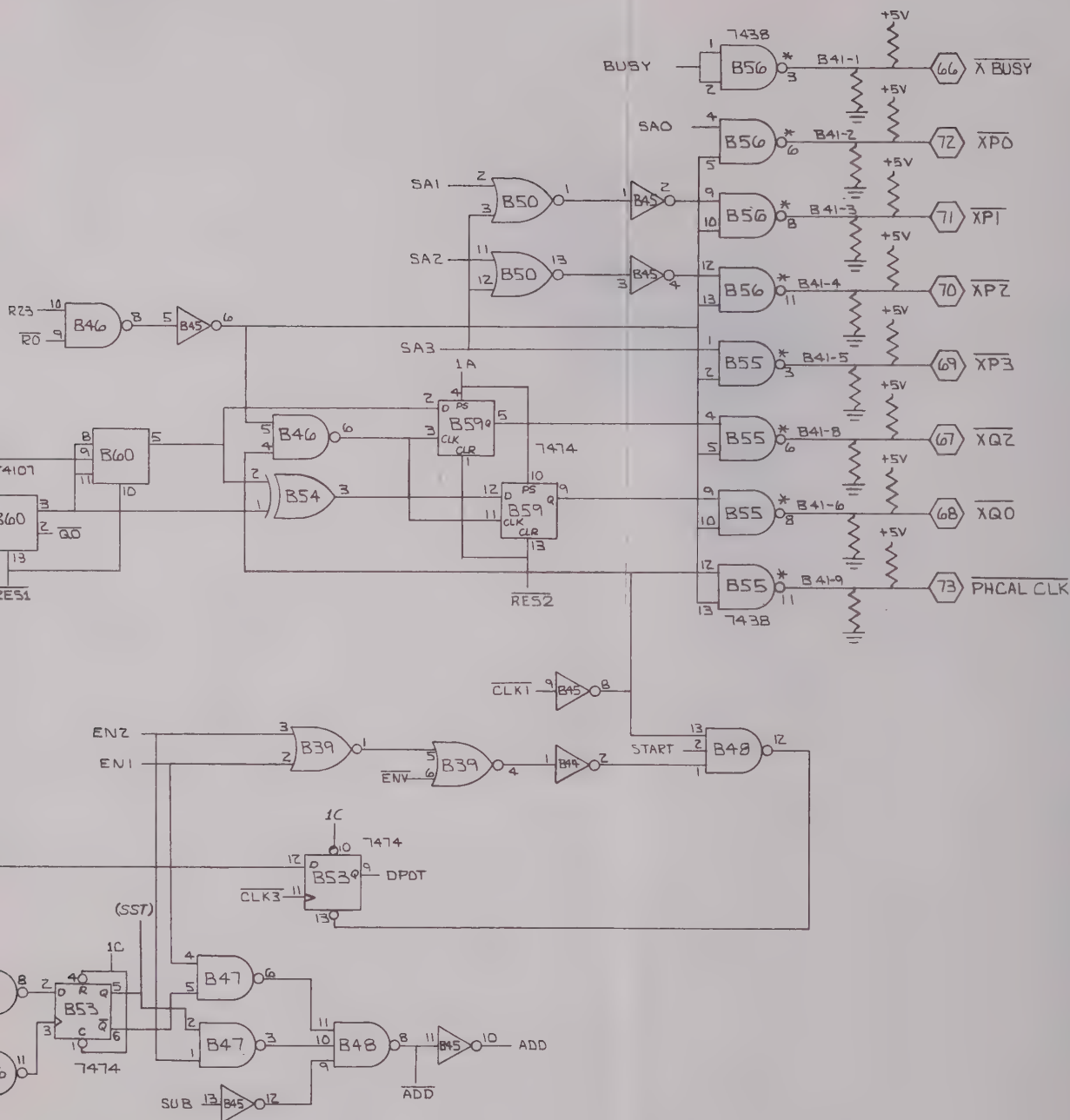


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REV	ECN	BY	DATE	APP
B	SEE ECN*1805	DC	9-18-78	



- PCRAP

REMOVE ALL BURRS AND BREAK SHARP EDGES		DRAWN BA		DATE 7-11-75		WAVETEK		SAN DIEGO • CALIFORNIA			
MATERIAL /		PROJ/ENGR				TITLE SCHEMATIC SINE CALCULATOR 1					
		RELEASE APPROV									
FINISH WAVETEK PROCESS /		TOLERANCE UNLESS OTHERWISE SPECIFIED .XX X .010 ANGLES :1" XX X .030									
		DO NOT SCALE DWG				MODEL NO.		DWG NO.		REV	
SCALE /						152		D152-255		B	
						CODE IDENT 23338		SHEET 1		OF 3	

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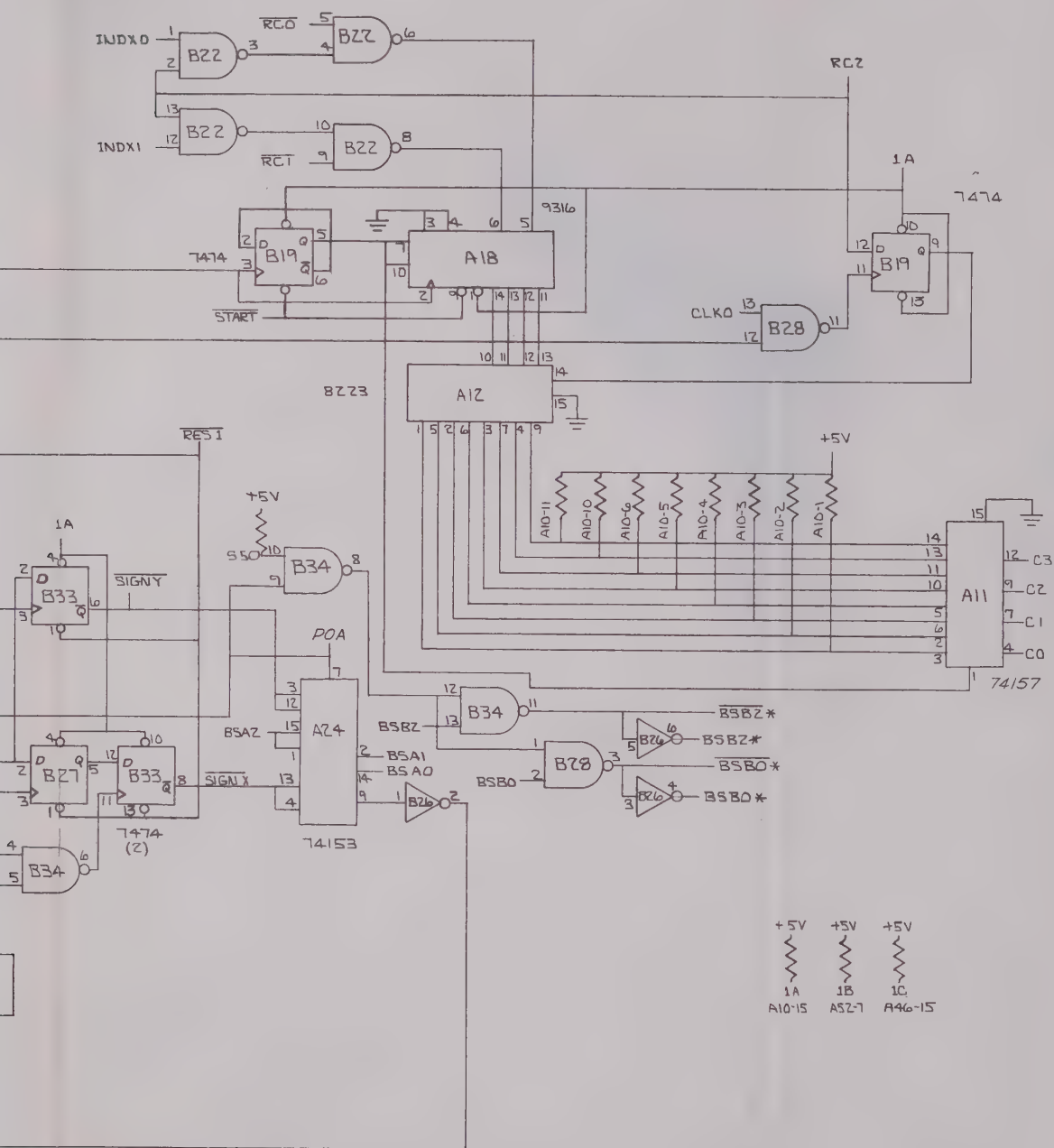
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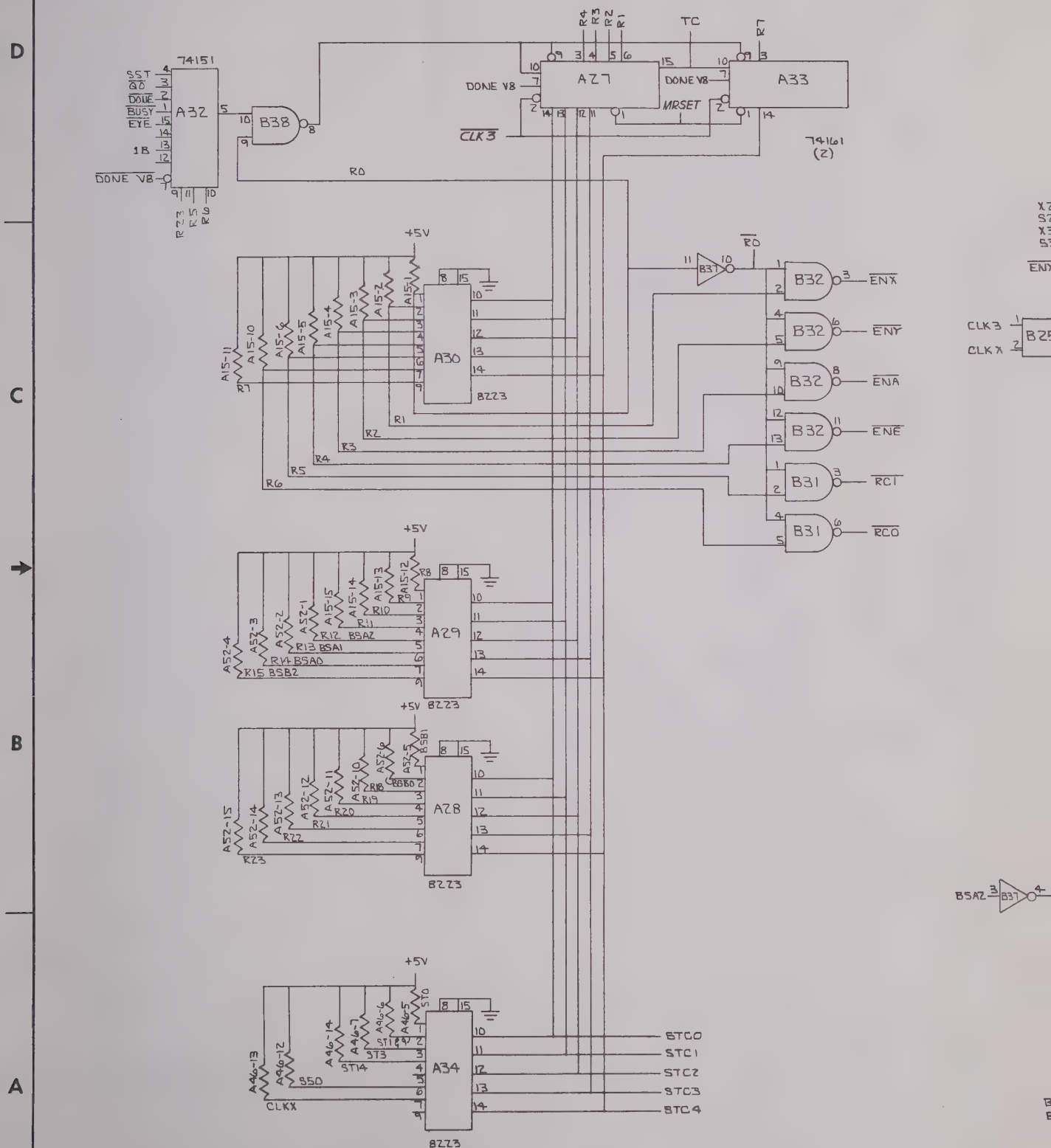
REV ECN BY DATE APP



+5V +5V +5V
 1A 1B 1C
 A10-15 A52-7 A96-15

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN B A	DATE 9-11-75	WAVETEK SAN DIEGO • CALIFORNIA	
MATERIAL /	PROJ ENGR	RELEASE APPROV	TITLE SCHEMATIC SINE CALCULATOR	
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° XX ±.030		MODEL NO 152	DWG NO D152-255
	DO NOT SCALE DWG	SCALE /	CODE IDENT 23338	REV B
			SHEET 2 OF 3	

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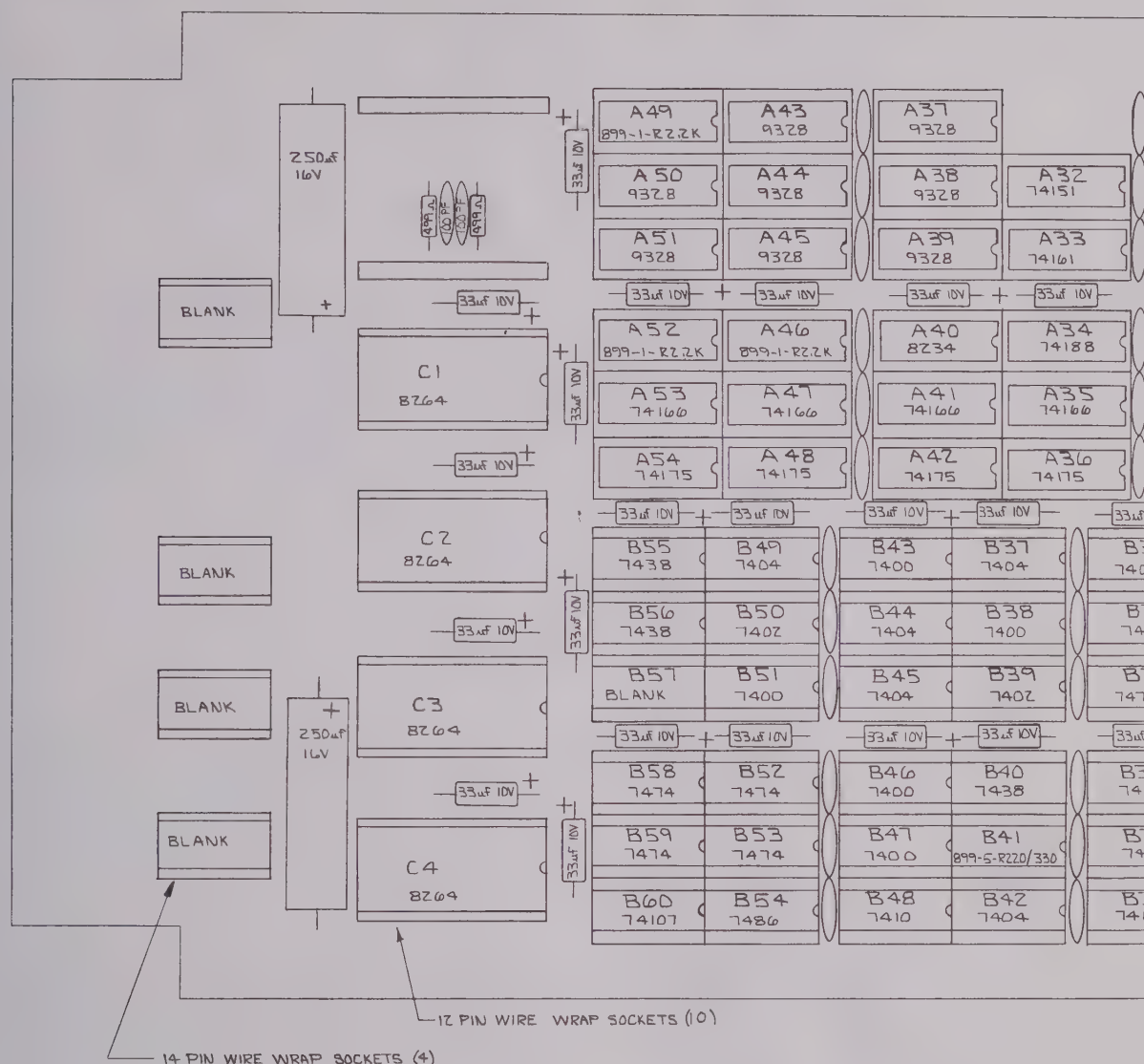


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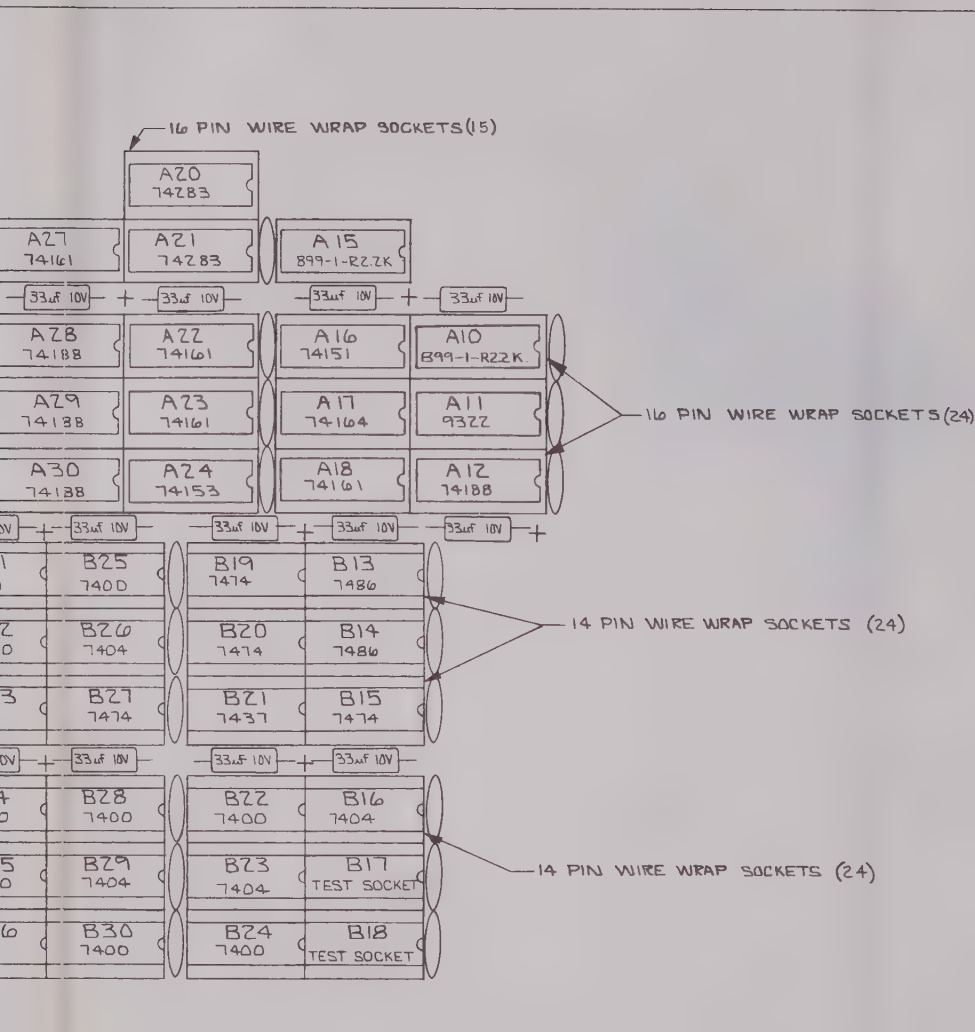
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REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN BA	DATE 7-17-75	WAVETEK SAN DIEGO • CALIFORNIA	
MATERIAL	PROJECT ENGR		TITLE SCHEMATIC	
	RELEASE APPROV		SINE CALCULATOR	
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XX" ± .010 ANGLES 1" XX ± .030			
	DO NOT SCALE DWG		MODEL NO. 152	DWG NO. D152-255
	SCALE		REV 18	
			CODE IDENT 23338	SHEET 3 OF 3

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2. USE WIRE WRAP BD. 152-177,
1. ALL CAP ARE .1μF 10V
NOTE: UNLESS OTHERWISE SPECIFIED



REMOVE ALL BURRS AND BREAK SHARP EDGES		DRAWN SA	DATE 9-15-15	WAVETEK SAN DIEGO • CALIFORNIA	
MATERIAL		PROJ ENGR		TITLE ASSEMBLY SINE CALCULATOR	
FINISH WAVETEK PROCESS		RELEASE APPROV		TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° XX ±.030	
		DO NOT SCALE DWG		MODEL NO 152	DWG NO D152-055
		SCALE		CODE IDENT 23338	REV A
				SHEET	OF

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NOTE: UNLESS OTHERWISE SPECIFIED

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		REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	CAP,CER,.1MF,10V	UK10-104	ARCO	1500-01-0412	43
NONE	CAP,MICA,100PF,500V	DM15-101J	ARCO	1500-11-0100	2
NONE	CAP,ELECT,250MF,16V	500D257G016DF7	SPRAG	1500-32-5101	2
NONE	CAP,TANT,33MF,10V	150D336X9010B2	SPRAG	1500-73-3601	33
NONE	SINE CALCULATOR	152-122	WVTK	1700-00-0672	1
NONE	SKT,IC,14P,N,HW	CSA2200-148C	SAE	2100-03-0002	52
NONE	SKT,IC,16P,N,HW	CSA2200-168C	SAE	2100-03-0003	39
NONE	SKT,IC,12P,N,HW	CSA2300-128C	SAE	2100-03-0004	10
NONE	RES,MF,1/8 1X,499	RN55D-4990F	TRW	4701-03-4990	2
NONE	RES MODULE	899-1-R2.2K	BECK	4770-00-0002	5
NONE	RES MODULE	899-S-R220/330	BECK	4770-00-0004	1
NONE	IC	7400	TI	8000-74-0000	14
NONE	IC	7402	TI	8000-74-0200	2
NONE	IC	7404	TI	8000-74-0400	10
NONE	IC	7410	TI	8000-74-1000	2
NONE	IC	7437	TI	8000-74-3700	1
NONE	IC	7438	TI	8000-74-3800	3
NONE	IC	7474	TI	8000-74-7400	9

WAVETEK
PARTS LIST

TITLE
PCA,SINE CALCULATOR

ASSEMBLY NO.
1100-00-0672
PAGE: 1

REV

800-4 BUSINESS FORMS PARTIAL, INC. 2187

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	IC	7486	TI	8000-74-8600	3
NONE	IC	8234	SIG	8000-82-3400	1
NONE	IC	8264	SIG	8000-82-6400	4
NONE	IC	8277	FAIR	8000-82-7700	8
NONE	IC	9322	SIG	8000-93-2200	1
NONE	IC	74107	TI	8007-41-0700	1
NONE	IC	74151	TI	8007-41-5100	2
NONE	IC	74153	TI	8007-41-5300	1
NONE	IC	74161	TI	8007-41-6100	5
NONE	IC	74164	TI	8007-41-6400	1
NONE	IC	74166	TI	8007-41-6600	4
NONE	IC	74175	TI	8007-41-7500	4
NONE	IC,UNPROGRAMMED REF 8500 OR 8600 SERIES PART NUMBERS	74188	TI	8007-41-8800	5
NONE	IC	74283	TI	8007-42-8300	2

WAVETEK
PARTS LIST

TITLE
PCA,SINE CALCULATOR

ASSEMBLY NO.
1100-00-0672
PAGE: 2

REV

800-4 BUSINESS FORMS PARTIAL, INC. 2187

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA	TITLE SINE CALC BD
MATERIAL	PROJ ENGR			
	RELEASE APPROV			
	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES :1° .XX ±.030			
FINISH WAVETEK PROCESS	DO NOT SCALE DWG	MODEL NO. 152		
	SCALE	CODE IDENT 23338	SHEET 1 OF 1	

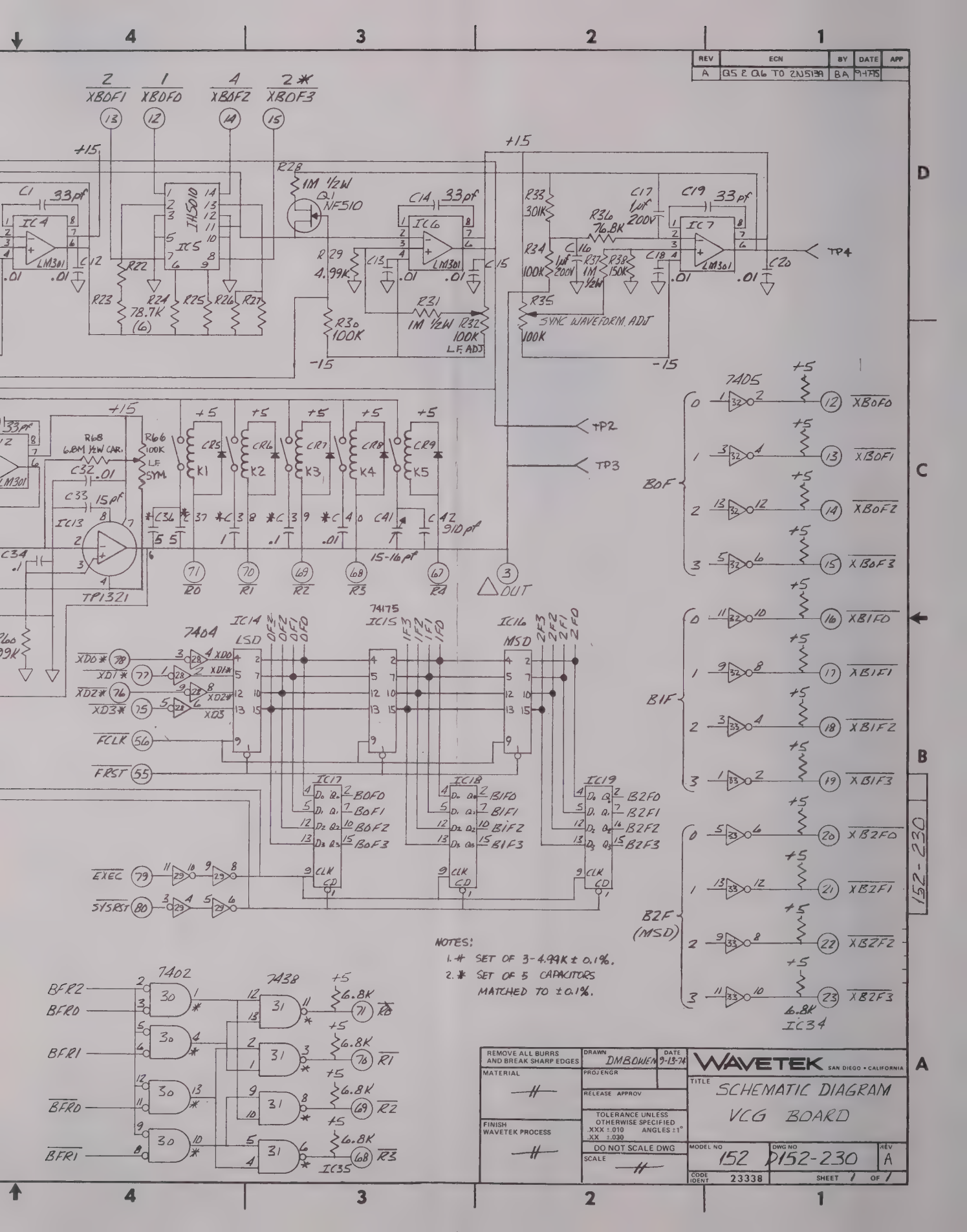
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800-4 BUSINESS FORMS PARTIAL, INC. 2187



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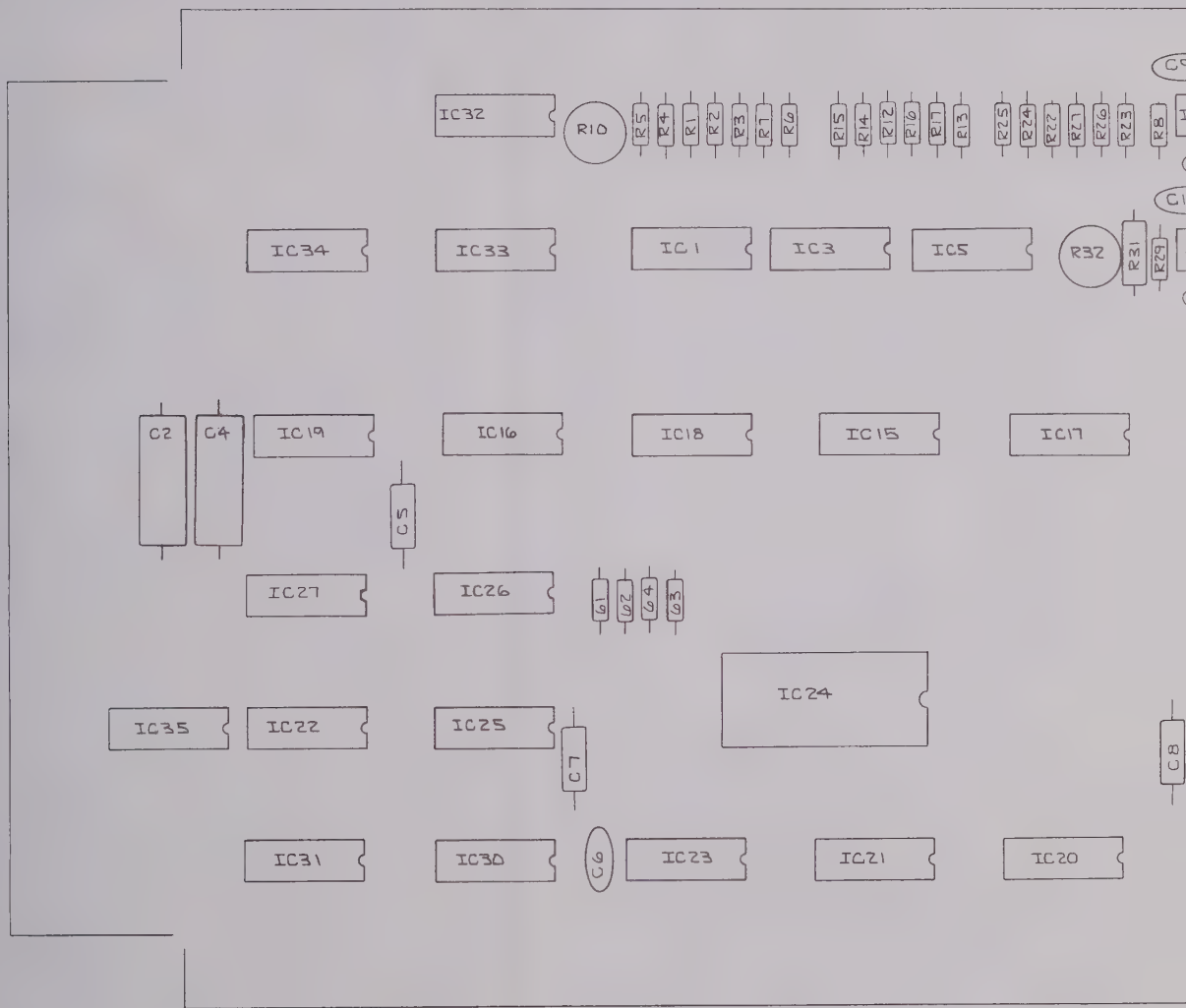
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NOTE: UNLESS OTHERWISE SPECIFIED



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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MF
NONE	CAP,CER,SPF,1KV	DD-050
NONE	CAP,CER,10PF,1KV	DD-100
NONE	CAP,CER,.01MF,50V	CK-103
NONE	CAP,CER,.1MF,50V	CK-104
NONE	CAP,CER,33PF,1KV	DD-330
NONE	CAP,MICA,910PF,100V	DM15-91
NONE	CAP,ELECT,100MF,16V	500D107
NONE	CAP,POLYC,1MF,100V	210-81C
NONE	VARI,15-60PF,200V	538-011
NONE	CAP,TANT,33MF,10V	150D336
NONE	CAP,SET,POLYC CONSIST:1509-90-0001 THRU:0004	130-501
NONE	VCG BOARD	152-130
NONE	PIN,MALE	61182-2
NONE	RELAY,REED,FORM-A	RA3019-
NONE	POT,TRIM,1K	91AR1K
NONE	POT,TRIM,100K	91AR100
NONE	POT,TRIM,500	91AR500
WAVETEK PARTS LIST		TITLE PCA,VCG

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MF
NONE	RES,C,1/2W,5%,1M	RC20GF-
NONE	RES,C,1/2W,10%,6.8M	RC20GF-
NONE	RES,MF,1/8W,1%,100	RN55D-1
NONE	RES,MF,1/8W,1%,1K	RN55D-1
NONE	RES,MF,1/8W,1%,10K	RN55D-1
NONE	RES,MF,1/8W,1%,100K	RN55D-1
NONE	RES,MF,1/8W,1%,12.1K	RN55D-1
NONE	RES,MF,1/8W,1%,15K	RN55D-1
NONE	RES,MF,1/8W,1%,150K	RN55D-1
NONE	RES,MF,1/8W,1%,2.21K	RN55D-2
NONE	RES,MF,1/8W,1%,301K	RN55D-3
NONE	RES,MF,1/8W,1%,33.2	RN55D-3
NONE	RES,MF,1/8W,1%,40.2K	RN55D-4
NONE	RES,MF,1/8W,1%,4.32K	RN55D-4
NONE	RES,MF,1/8W,1%,4.99K	RN55D-4
NONE	RES,MF,1/8W,1%,76.8K	RN55D-7
WAVETEK PARTS LIST		TITLE PCA,VCG

NOTE UNLESS OTHERWISE SPECIFIED

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R=PART-NO	MFGR	WAVETEK NO.	QTY/PT
	CRL	1500-00-5011	2
	CRL	1500-01-0011	1
ONG LEAD	CRL	1500-01-0300	15
	CRL	1500-01-0410	1
	CRL	1500-03-3011	8
	ARCO	1500-19-1101	1
016DC7	SPRAG	1500-31-0101	2
105F	IMB	1500-41-0504	3
112F	ERIE	1500-56-0010	1
901082	SPRAG	1500-73-3601	3
6	WVTK	1509-80-0005	1
	WVTK	1700-00-0145	1
	AMP	2100-05-0020	6
051	ETROL	4500-00-0007	5
	BECK	4600-01-0209	1
	BECK	4600-01-0402	3
	BECK	4600-05-0104	1

ASSEMBLY NO.
1100-00-0145

PAGE: 1

REV

REFERENCE DESIGNATORS

PART DESCRIPTION

ORIG-MFGR-PART-NO

MFGR

WAVETEK NO.

QTY/PT

NONE

RES,WF,1/8W,1%,78.7K

RN550-7872F

TRW

4701-03-7872

18

NONE

RES MODULE

899-1-R6,8K

BECK

4770-00-0003

2

NONE

RES,BET,3-4.99K,1/8W

4789-00-0046

WVTK

4789-00-0046

1

QTY:4701-03-4991

NONE

DIODE

FD-6666

FAIR

4807-02-6666

9

NONE

TRANS

2N3646

FAIR

4901-03-6460

4

NONE

TRANS

2N3905

FAIR

4901-03-9050

1

NONE

TRANS

2N5139

FAIR

4901-05-1390

3

NONE

TRANS

NF-510

NSC

4902-00-5100

1

NONE

IC

LM 301AN

NSC

7000-03-0100

5

NONE

IC

TP1321

TLDYN

7000-13-2100

1

NONE

IC

CA-3080

RCA

7000-30-8000

3

NONE

IC

5010

INT8L

7000-50-1000

3

NONE

IC,CLASS I,CA-3039

130-501-18

WVTK

7200-00-0004

1

QTY:1:7000-30-3900

NONE

IC

7402

TI

8000-74-0200

1

NONE

IC

7404

TI

8000-74-0400

4

NONE

IC

7405

TI

8000-74-0500

2

WAVETEK
PARTS LIST

TITLE
PCA,VCG

ASSEMBLY NO.
1100-00-0145

PAGE: 3

REV

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DATE

APP

R=PART-NO	MFGR	WAVETEK NO.	QTY/PT
05	STKPL	4700-25-1004	3
05	STKPL	4700-25-6804	1
00F	TRW	4701-03-1000	6
01F	TRW	4701-03-1001	1
02F	TRW	4701-03-1002	1
03F	TRW	4701-03-1003	1
00F	TRW	4701-03-1009	1
12F	TRW	4701-03-1212	1
02F	TRW	4701-03-1502	5
03F	TRW	4701-03-1503	1
11F	TRW	4701-03-2211	4
13F	TRW	4701-03-3013	1
02F	TRW	4701-03-3329	3
02F	TRW	4701-03-4022	4
01F	TRW	4701-03-4321	2
01F	TRW	4701-03-4991	6
02F	TRW	4701-03-7682	1

ASSEMBLY NO.
1100-00-0145

PAGE: 2

REV

REFERENCE DESIGNATORS

PART DESCRIPTION

ORIG-MFGR-PART-NO

MFGR

WAVETEK NO.

QTY/PT

NONE

IC

7430

TI

8000-74-3000

1

NONE

IC

7438

TI

8000-74-3800

3

NONE

IC

8264

SIG

8000-82-6400

1

NONE

IC

74175

TI

8007-41-7500

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WAVETEK
PARTS LIST

TITLE
PCA,VCG

ASSEMBLY NO.
1100-00-0145

PAGE: 4

REV

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REMOVE ALL BURRS
AND BREAK SHARP EDGES

DRAWN

DATE

MATERIAL

PROJ ENGR

RELEASE APPROV

FINISH
WAVETEK PROCESS

TOLERANCE UNLESS
OTHERWISE SPECIFIED
XXX-.010 ANGLES:1°
XX-.030

DO NOT SCALE DWG

SCALE

WAVETEK
SAN DIEGO • CALIFORNIA

TITLE
VCG BD

MODEL NO
152

DWG NO
1100-00-0145

REV

CODE
IDENT

23338

SHEET

OF

SINE CONVERTOR

IV SINE

HIGH
FILTER

+15V

-15V

GND

+5V

LOW PASS FILTER

LAST REF DESIG USED

CAP C5.7
DIODE CR17
RES R114
INT CIR IC13

1. ALL DIODES ARE FD66666
2. ALL CAPACITOR VALUES ARE IN MICROFARADS (μF)
3. ALL RESISTOR VALUES ARE IN OHMS (Ω)
4. * RESISTORS R36, R37, R43, R45 MATCHED TO $\pm 1\%$

NOTE: UNLESS OTHERWISE SPECIFIED

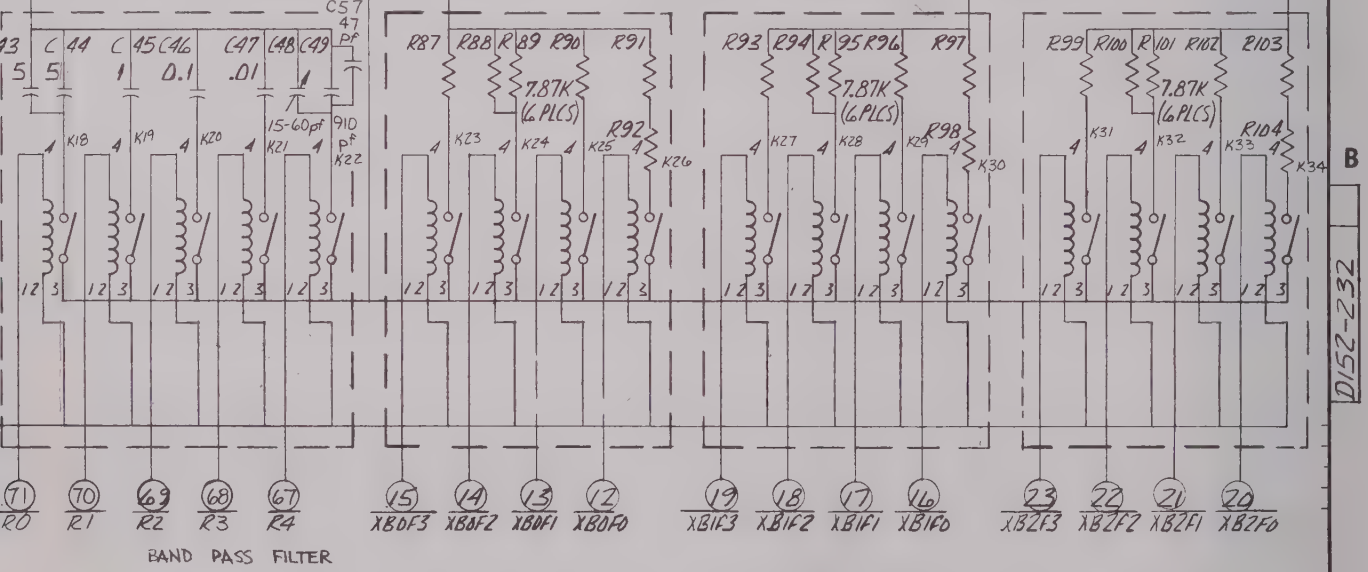
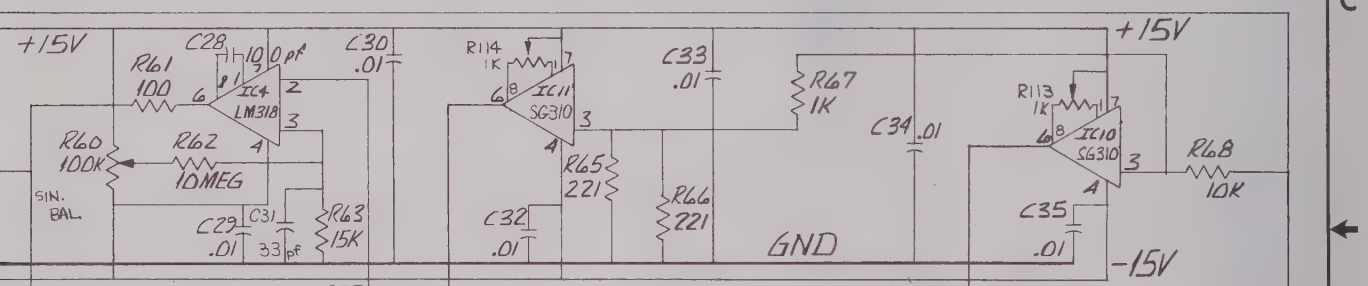
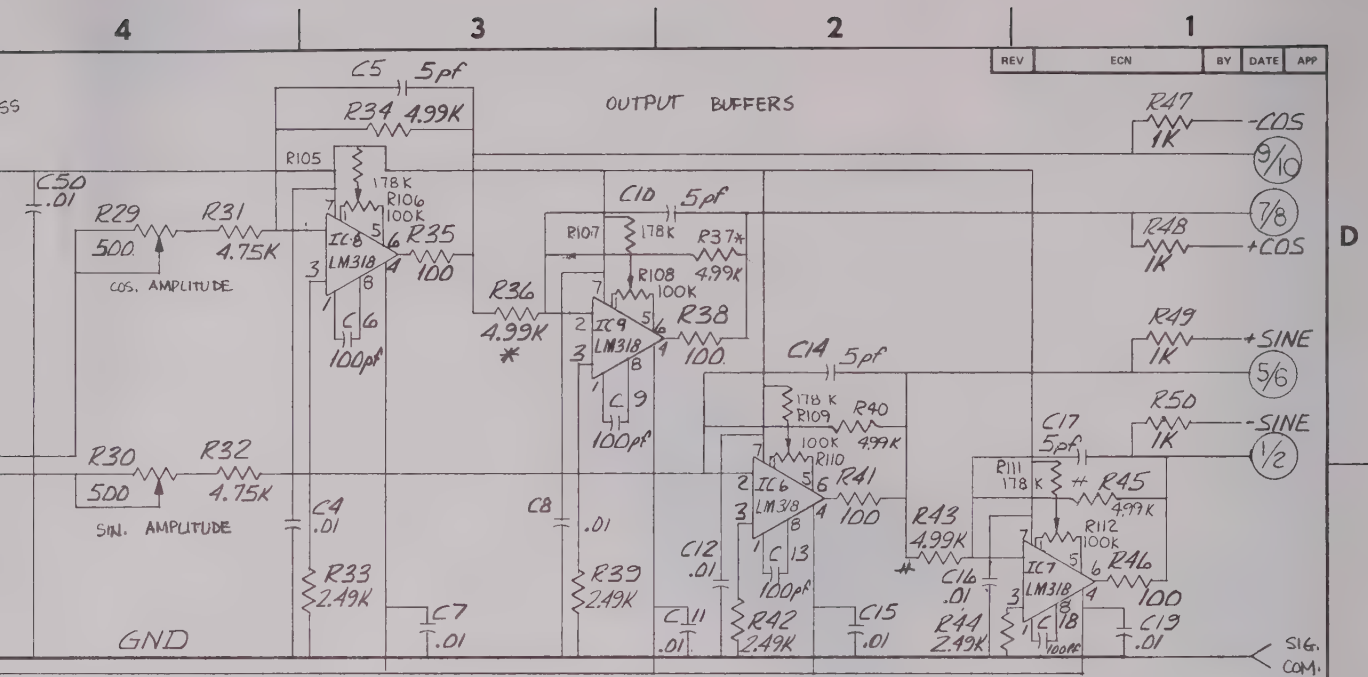
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BRUNING 40-520 15921



REMOVE ALL BURRS AND BREAK SHARP EDGES		DRAWN DM BOWLEN	DATE 9-7-74	WAVETEK SAN DIEGO • CALIFORNIA SCHEMATIC DIAGRAM FILTER BD
MATERIAL		PROJ ENGR	TITLE	
FINISH WAVETEK PROCESS		RELEASE APPROV	MODEL NO. 152	
DO NOT SCALE DWG		SCALE	DWG NO. D152-232	
TOLERANCE UNLESS OTHERWISE SPECIFIED .XX ±.010 ANGLES ±1° .XX ±.030		CODE IDENT 23338		REV A
SHEET 1 OF 1				

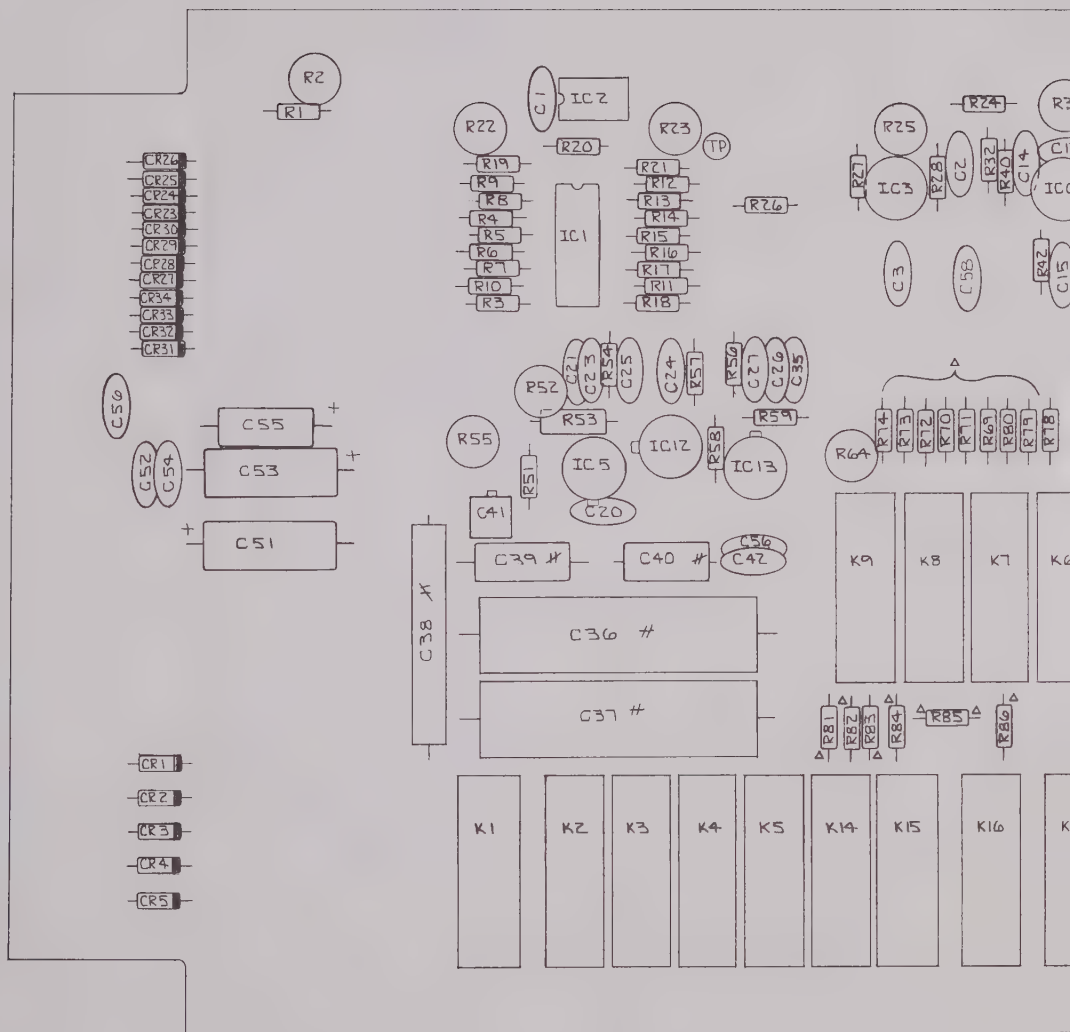
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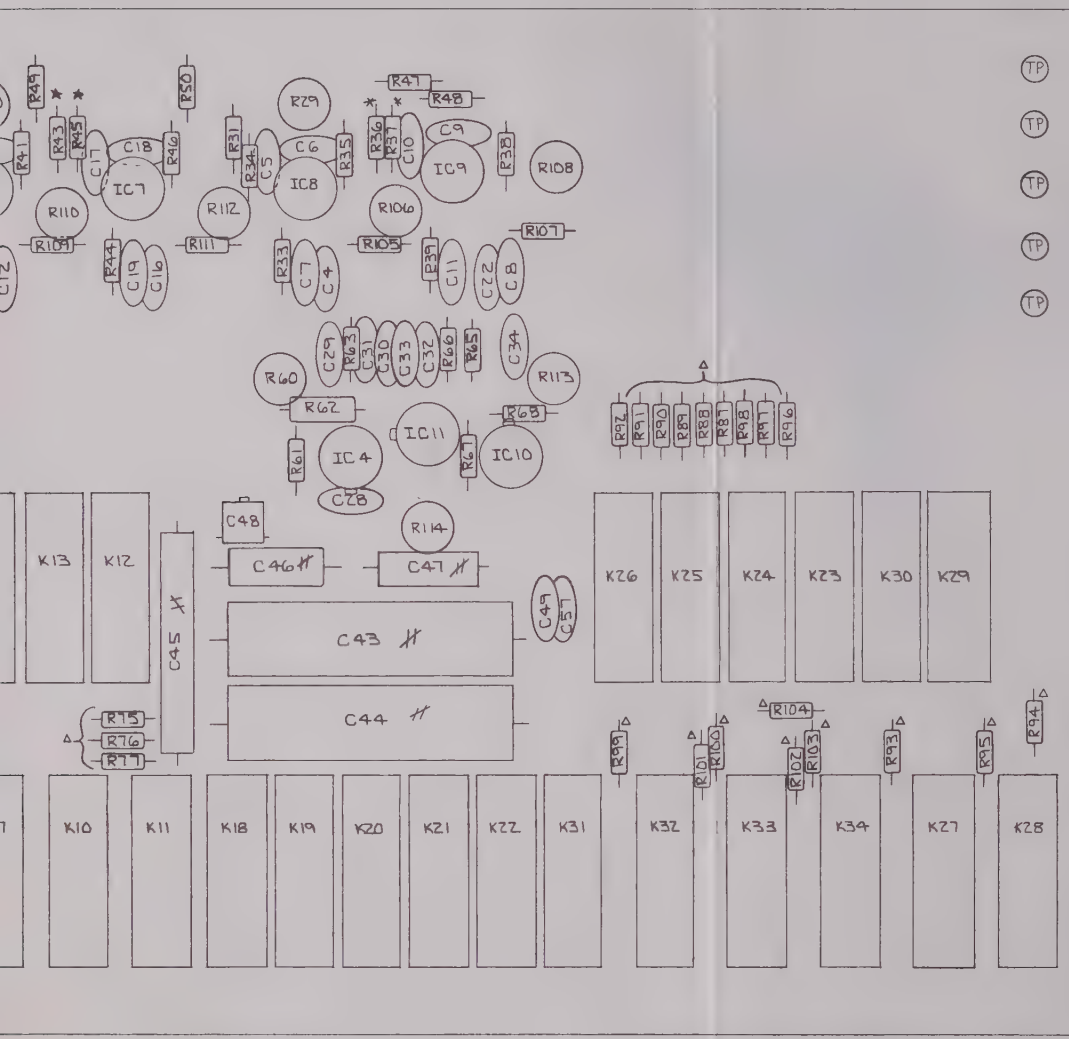
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4. Δ MATCHED SET TO $\pm 0.1\%$
3. ∇ MATCHED SET $\pm 0.1\%$ OF PRINTED VALUE
2. * MATCHED SET $\pm 0.1\%$
1. ★ MATCHED SET $\pm 0.1\%$

NOTE UNLESS OTHERWISE SPECIFIED



REMOVE ALL BURRS AND BREAK SHARP EDGES		DRAWN ADKINS		DATE 2-13-75		WAVETEK SAN DIEGO • CALIFORNIA	
MATERIAL		PROJ ENGR		TITLE		ASSEMBLY FILTER BOARD	
FINISH WAVETEK PROCESS		RELEASE APPROV		TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030		MODEL NO. 152	
DO NOT SCALE DWG		SCALE 2/1		DWG NO. D15Z-032		REV A	
CODE IDENT		23338		SHEET 1		OF	

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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFG#-PART-N
NONE	CAP,CER,5PF,1KV	DD-050
NONE	CAP,CER,100PF,1KV	DD-101
NONE	CAP,CER,,01MF,50V	CK-103 LONG LEAD
NONE	CAP,CER,33PF,1KV	DD-330 LONG LEAD
NONE	CAP,MICA,47PF,500V	DM15-470J
NONE	CAP,MICA,910PF,100V	DM15-911F
NONE	CAP,ELECT,100MF,16V	500D107G016DC7
NONE	VARI,15-60PF,200V	538-006-112F
NONE	CAP,TANT,33MF,10V	150D336X9010B2
NONE	CAP,SET,POLYC CONSIST:1509-90-0001 THRU:0004	130-501-6
NONE	FILTER BOARD	152-132-REPEAT
NONE	ADAPTER PLUG 16 PIN	616-BG1
NONE	RELAY,REED,FORM-A	RA3019-1051
NONE	POT,TRIM,100	91AR100
NONE	POT,TRIM,1K	91AR1K
NONE	POT,TRIM,100K	91AR100K
NONE	POT,TRIM,500	91AR500
WAVETEK PARTS LIST		TITLE PCA,FILTER ASSEM 1100- PAGE 1

NOTE: UNLESS OTHERWISE SPECIFIED

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REV ECN BY DATE APP

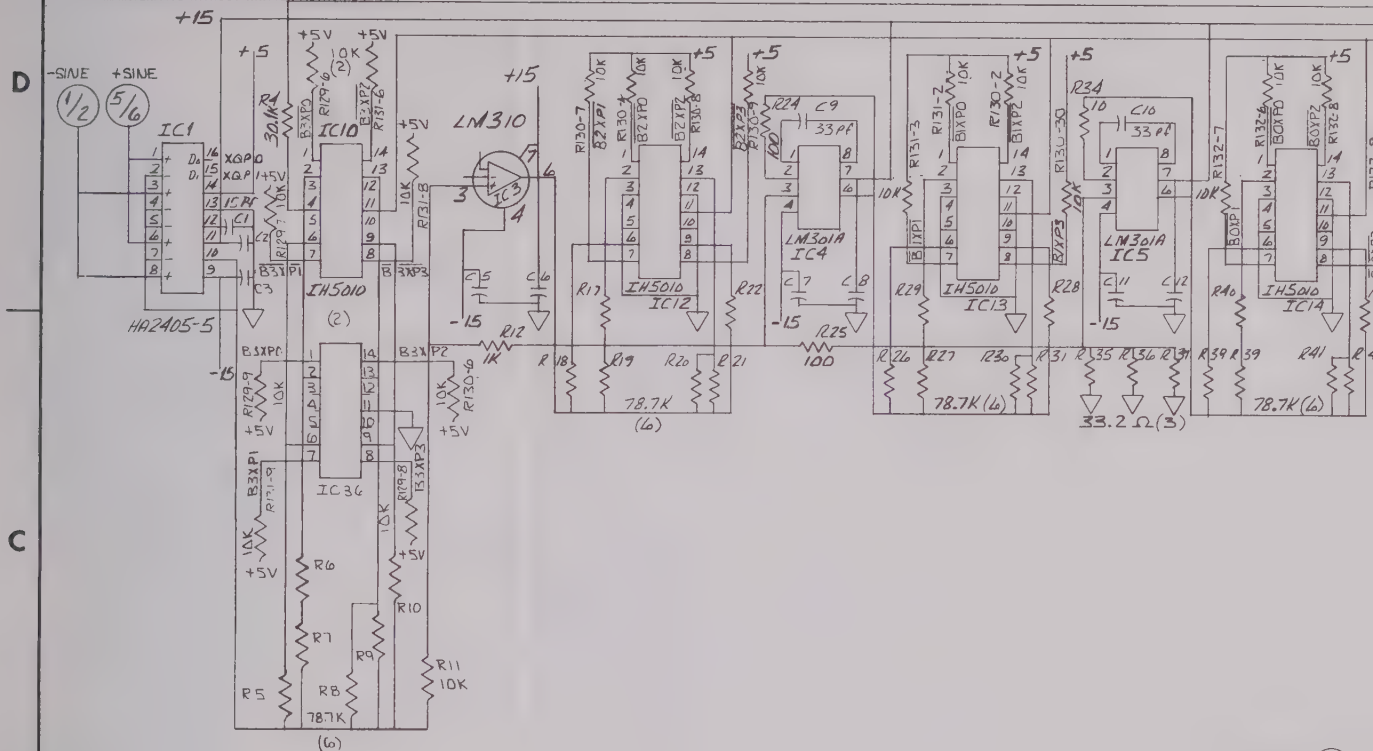
MFGR	WAVETEK NO.	QTY/PT
CRL	1500-00-5011	5
CRL	1500-01-0111	6
CRL	1500-01-0300	25
CRL	1500-03-3001	3
ARCO	1500-14-7000	2
ARCO	1500-19-1101	2
SPRAG	1500-31-0101	2
ERIE	1500-56-0000	2
SPRAG	1500-73-3601	1
WVTK	1509-80-0005	2
WVTK	1700-00-0146	1
AUGAT	2100-02-0062	1
ETROL	4500-00-0007	34
BECK	4600-01-0103	3
BECK	4600-01-0209	4
BECK	4600-01-0402	7
BECK	4600-05-0104	2
NO. 0146	REV	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	RES,C,1/2W,5%,2.7M	RC20GF-275	STKPL	4700-25-2704	2
NONE	RES,MF,1/8W,1%,100	RN55D-1000F	TRW	4701-03-1000	7
NONE	RES,MF,1/8W,1%,1K	RN55D-1001F	TRW	4701-03-1001	6
NONE	RES,MF,1/8W,1%,10K	RN55D-1002F	TRW	4701-03-1002	4
NONE	RES,MF,1/8W,1%,100K	RN55D-1003F	TRW	4701-03-1003	1
NONE	RES,MF,1/8W,1%,12.1K	RN55D-1212F	TRW	4701-03-1212	3
NONE	RES,MF,1/8W,1%,15K	RN55D-1502F	TRW	4701-03-1502	2
NONE	RES,MF,1/8W,1%,150K	RN55D-1503F	TRW	4701-03-1503	2
NONE	RES,MF,1/8W,1%,178K	RN55D-1783F	TRW	4701-03-1783	4
NONE	RES,MF,1/8W,1%,18.2K	RN55D-1822F	TRW	4701-03-1822	1
NONE	RES,MF,1/8W,1%,200	RN55D-2000F	TRW	4701-03-2000	1
NONE	RES,MF,1/8W,1%,21.5K	RN55D-2152F	TRW	4701-03-2152	2
NONE	RES,MF,1/8W,1%,221	RN55D-2210F	TRW	4701-03-2210	4
NONE	RES,MF,1/8W,1%,2.49K	RN55D-2491F	TRW	4701-03-2491	4
NONE	RES,MF,1/8W,1%,274	RN55D-2740F	TRW	4701-03-2740	1
NONE	RES,MF,1/8W,1%,30.1K	RN55D-3012F	TRW	4701-03-3012	2
NONE	RES,MF,1/8W,1%,301K	RN55D-3013F	TRW	4701-03-3013	1
WAVETEK PARTS LIST		TITLE PCA,FILTER		ASSEMBLY NO. 1100-00-0146 PAGE: 2	
				REV	

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	RES,MF,1/8W,1%,4.75K	RN55D-4751F	TRW	4701-03-4751	2
NONE	RES,MF,1/8,1%,499	RN55D-4990F	TRW	4701-03-4990	1
NONE	RES,MF,1/8W,1%,4.99K	RN55D-4991F	TRW	4701-03-4991	5
NONE	RES,MF,1/8W,1%,49.9K	RN55D-4992F	TRW	4701-03-4992	1
NONE	RES,MF,1/8W,1%,56.2K	RN55D-5622F	TRW	4701-03-5622	2
NONE	RES,SET,4-4.99K,1/8W QTY:44701-03-4991	180-500-100A	WVTK	4789-00-0039	1
NONE	RES,SET,36-7.87K QTY:136:4701-03-7871	4789-00-0045	WVTK	4789-00-0045	1
NONE	DIODE	FD-6666	FAIR	4807-02-6666	17
NONE	IC	LM 301AN	NSC	7000-03-0100	1
NONE	IC	7000-03-1000	WVTK	7000-03-1000	4
NONE	IC	LM318H	NSC	7000-03-1800	7
NONE	IC	CA-3019	RCA	7000-30-1900	4
WAVETEK PARTS LIST		TITLE PCA,FILTER		ASSEMBLY NO. 1100-00-0146 PAGE: 3	
				REV	

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA	
MATERIAL	PROJ ENGR		TITLE FILTER BD	
	RELEASE APPROV			
	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° XX ±.030			
FINISH WAVETEK PROCESS	DO NOT SCALE DWG	MODEL NO. 152	DWG NO. 1100-00-0146	REV
	SCALE	CODE IDENT 23338	SHEET	OF

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LAST REF DES USED

RES R128

CAP C38

IC'S IC44

NOT USED

R33 R69 R97

R44	R70	R98
R45	R71	R99

R97 R88 R100

R410	R90	R101
R57	R91	R135

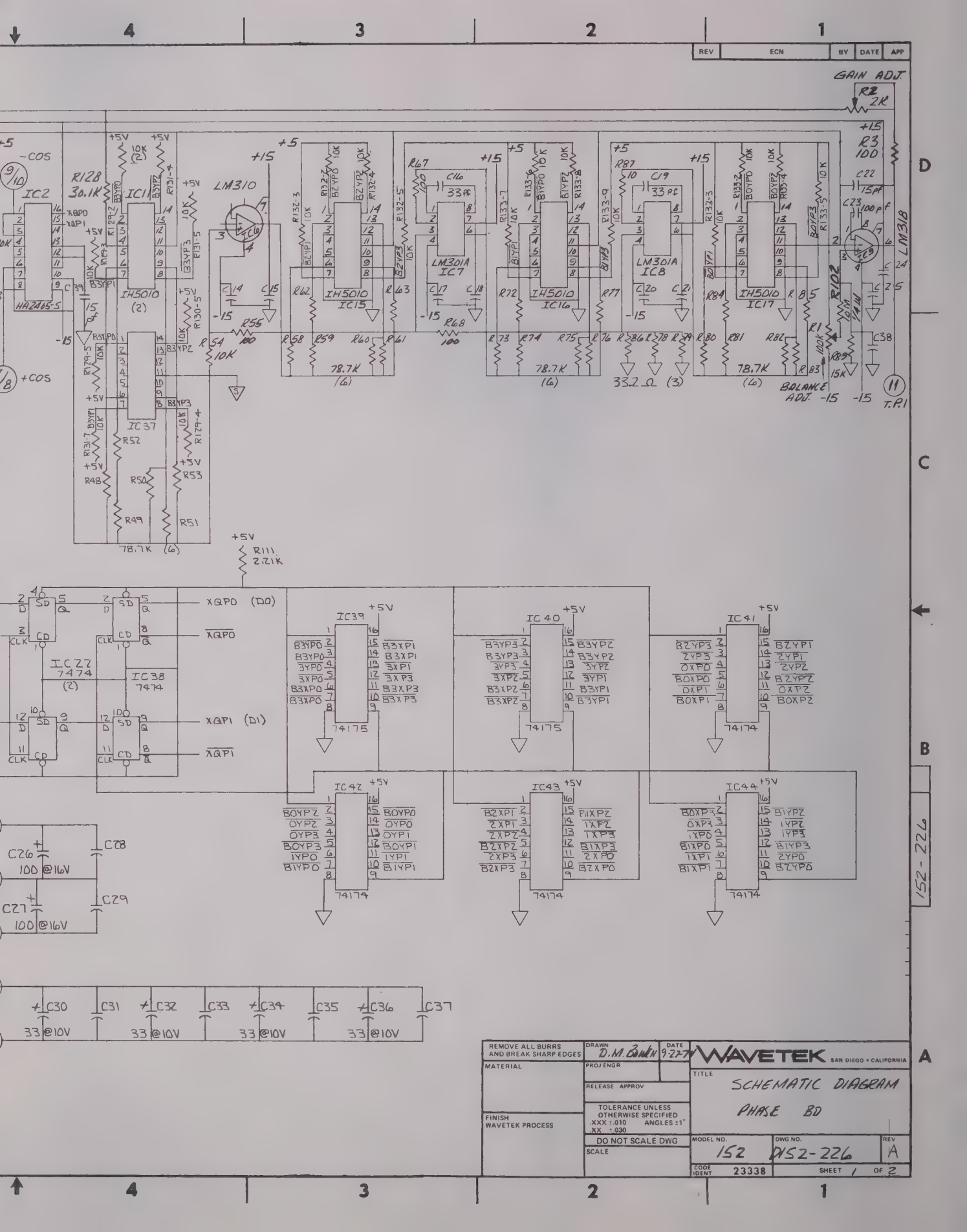
R64	R92	R126
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R65 R95 R120
R66 R95

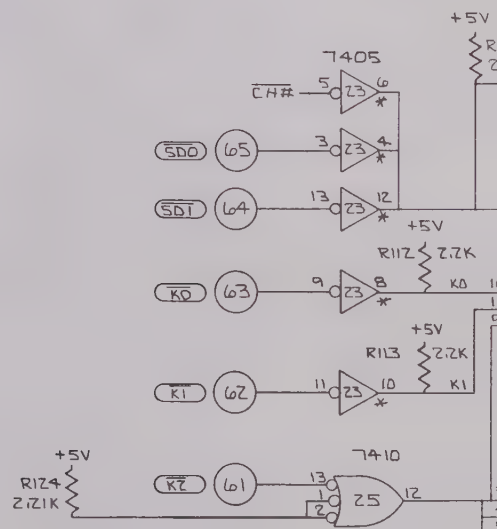
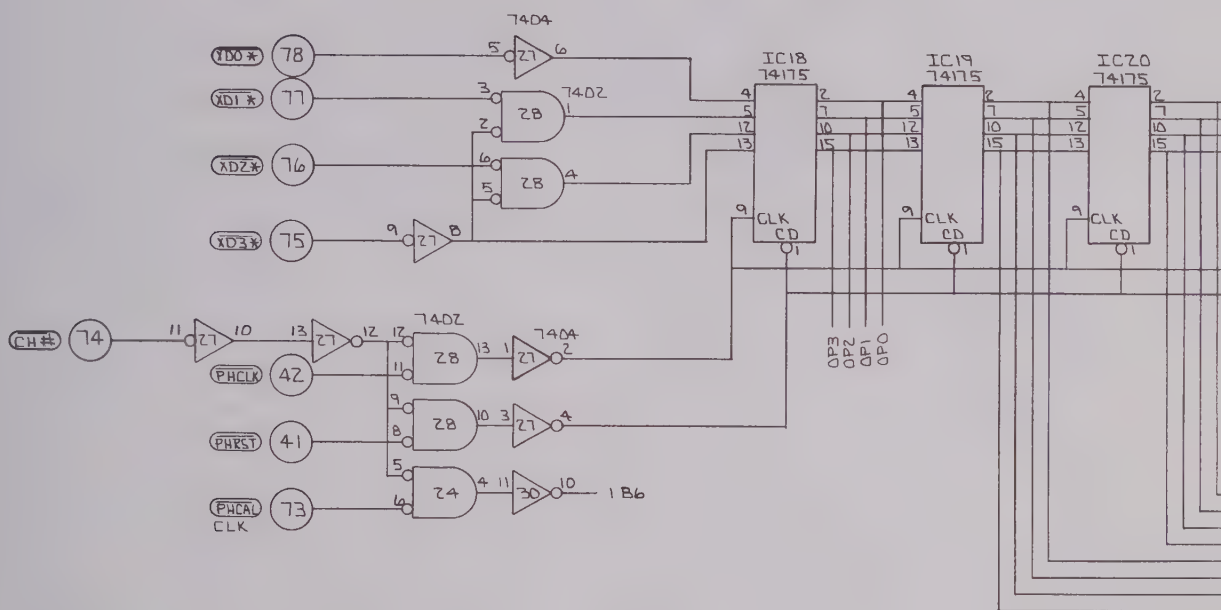
2. ALL CAPACITOR VALUES ARE IN MICROFARADS
& ARE .01 @ 50V EXCEPT WHERE SHOWN

1. ALL RESISTOR VALUES ARE IN OHMS (Ω)

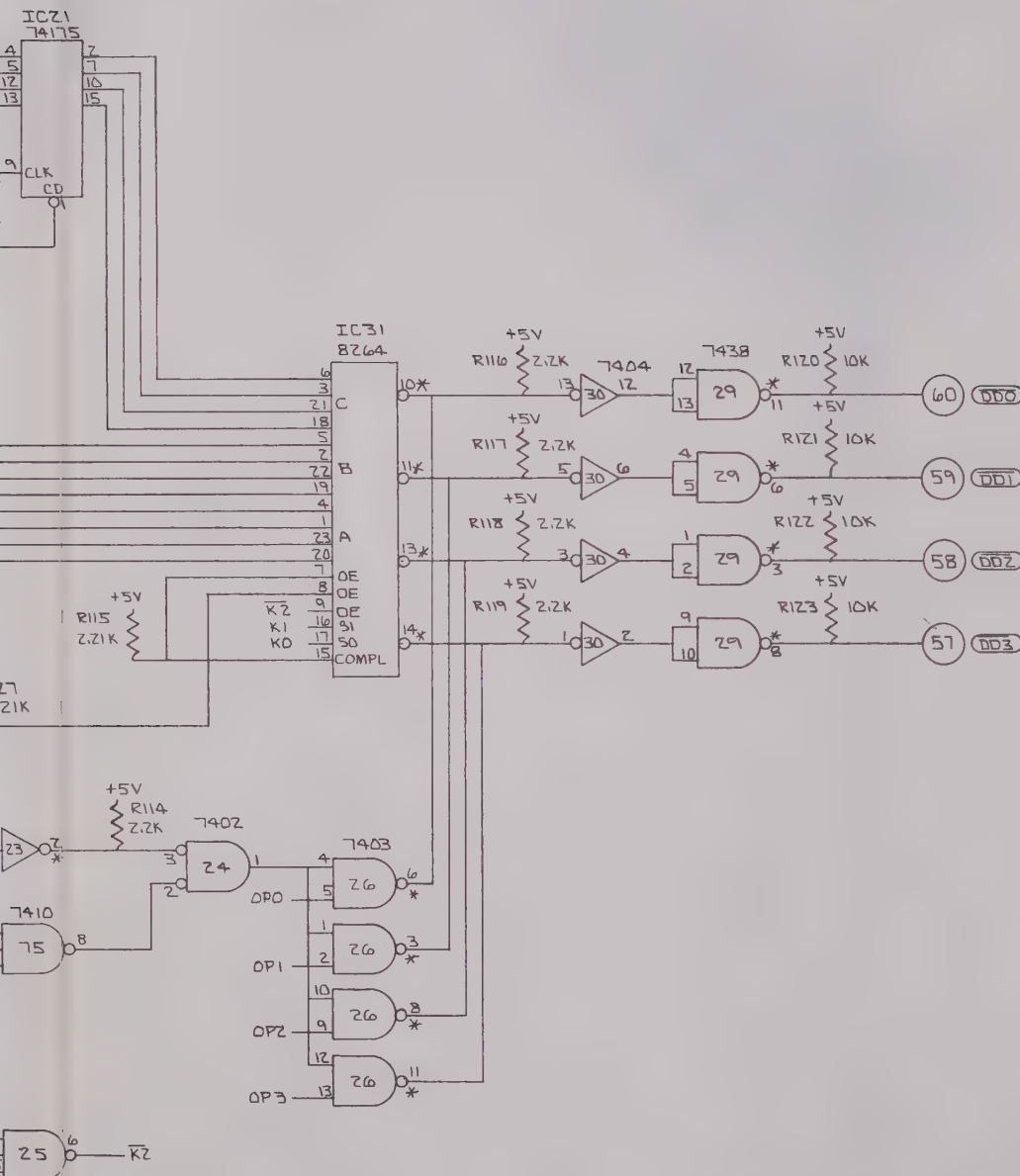
NOTE: UNLESS OTHERWISE SPECIFIED



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NOTE: UNLESS OTHERWISE SPECIFIED



REMOVE ALL BURRS AND BREAK SHARP EDGES		DRAWN BA	DATE 6-17-75	WAVETEK SAN DIEGO • CALIFORNIA TITLE SCHEMATIC PHASE BOARD			
MATERIAL		PROJ ENGR		RELEASE APPROV TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030 DO NOT SCALE DWG			
FINISH WAVETEK PROCESS		SCALE				MODEL NO 15Z	DWG NO D152-226
						REV A	
				CODE IDENT 23338	SHEET 2 OF 2		

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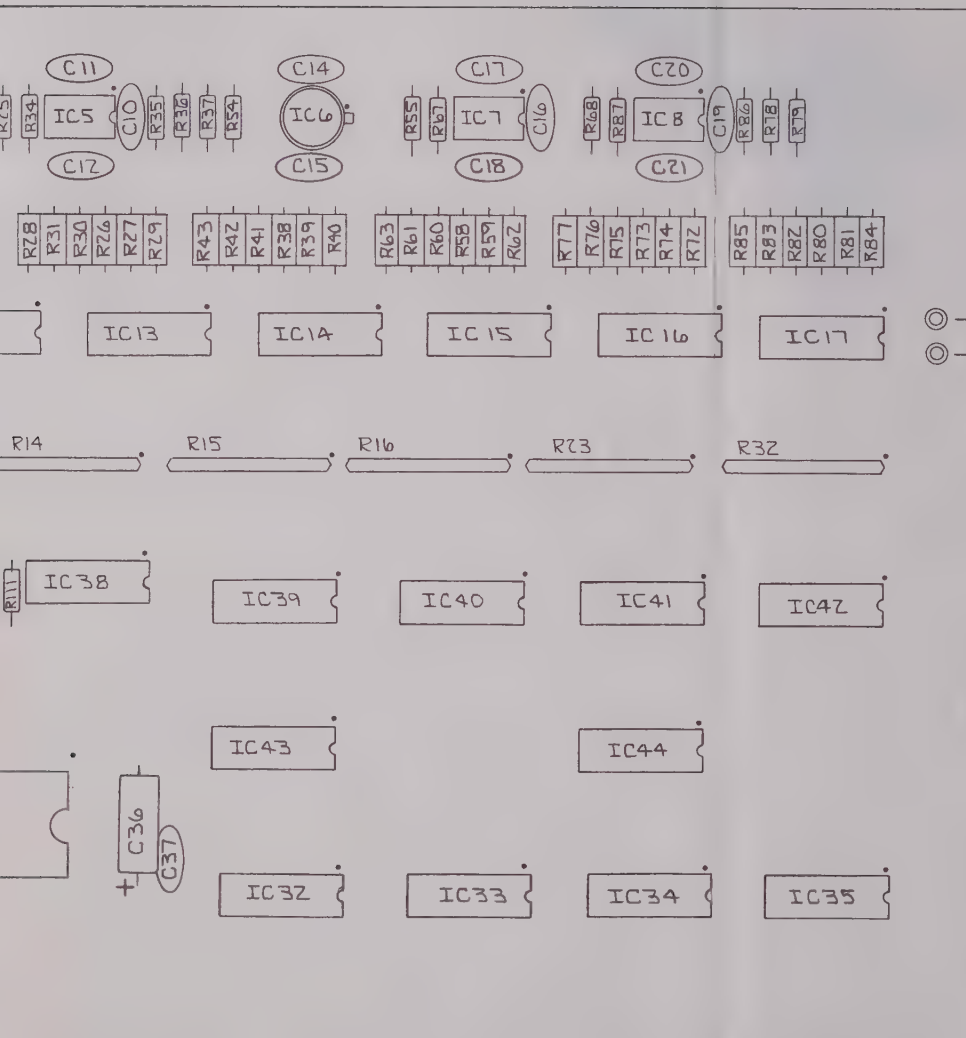
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REV ECN BY DATE APP



REMOVE ALL BURRS AND BREAK SHARP EDGES		DRAWN BA	DATE 6-20-75
MATERIAL		PROJ ENGR	
		RELEASE APPROV	
FINISH WAVETEK PROCESS		TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030	
DO NOT SCALE DWG		MODEL NO	152
SCALE 2/1		DWG NO.	DISZ-026
		CODE IDENT	23338
		SHEET /	OF 1
		TITLE ASSEMBLY PHASE BOARD	
		MODEL NO 152	
		DWG NO. DISZ-026	
		REV B	

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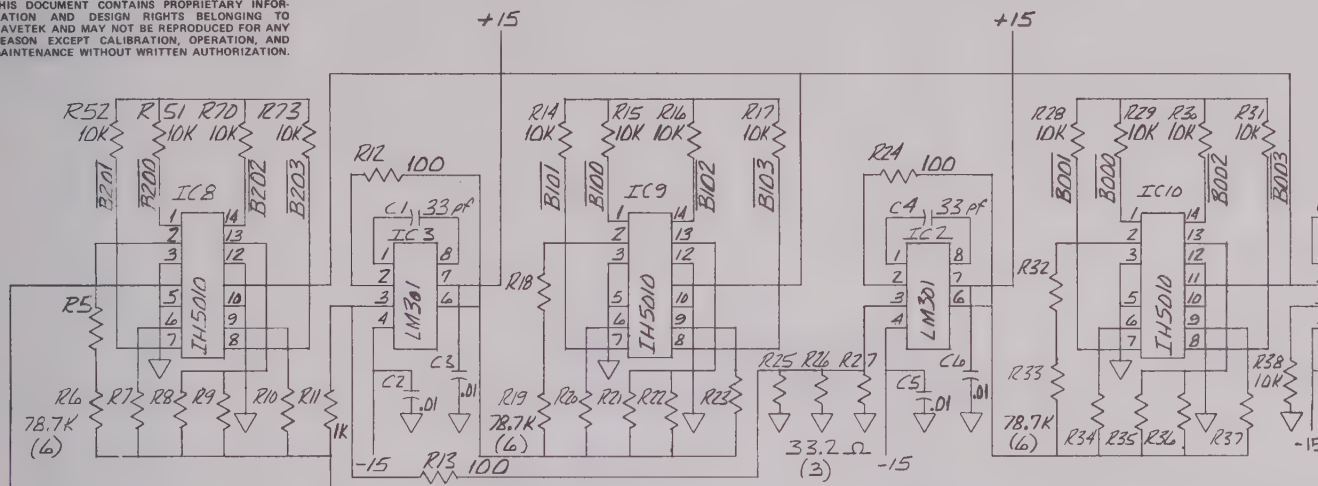
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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-N
NONE	CAP,CER,100PF,1KV	DD-101
NONE	CAP,CER,.01MF,50V	CK-103
NONE	CAP,CER,15PF,1KV	DD-150
NONE	CAP,CER,33PF,1KV	DD-330
NONE	CAP,ELECT,100MF,16V	500D107G016DC7
NONE	CAP,TANT,33MF,10V	150D336X9010B2
NONE	PHASE BOARD	152-126
NONE	SKT,IC,16PIN	16-DIP
NONE	PIN,MALE	61182-2
NONE	POT,TRIM,100K	91AR100K
NONE	POT,TRIM,2K	91AR2K
NONE	RES,C,1/2W,5%,10M	RC20GF-106
NONE	RES,MF,1/8W,1%,100	RN55D-1000F
NONE	RES,MF,1/8W,1%,1K	RN55D-1001F
NONE	RES,MF,1/8W,1%,10K	RN55D-1002F
NONE	RES,MF,1/8W,1%,10	RN55D-10R0F
NONE	RES,MF,1/8W,1%,15K	RN55D-1502F
NONE	RES,MF,1/8W,1%,2.21K	RN55D-2211F
WAVETEK PARTS LIST		TITLE PCA, PHASE BOARD
		ASSEM 1100- PAGE:

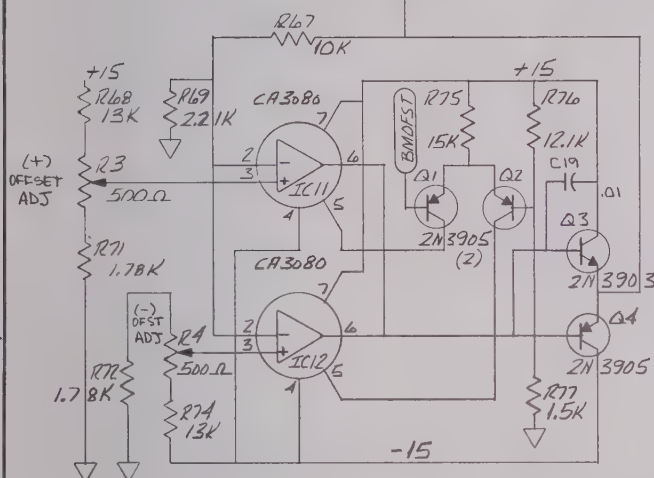
4			3			2			1		
						REV	ECN		BY	DATE	APP
</											

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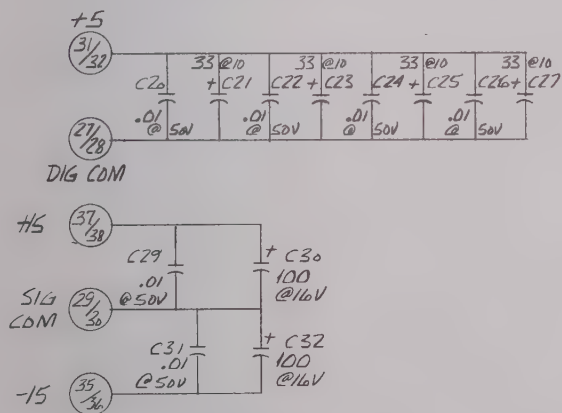
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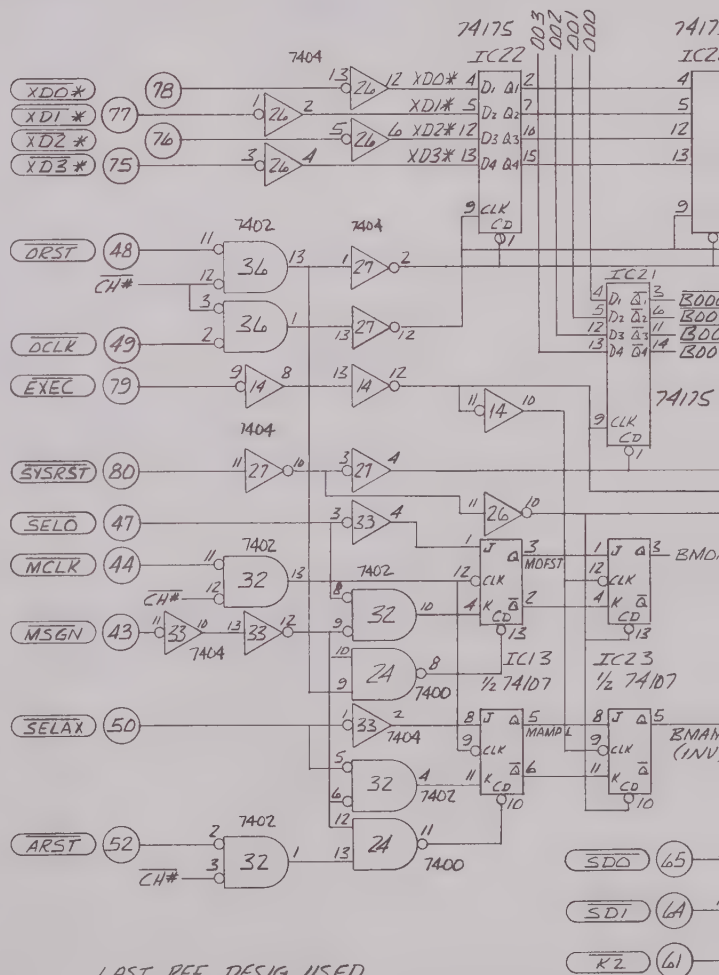


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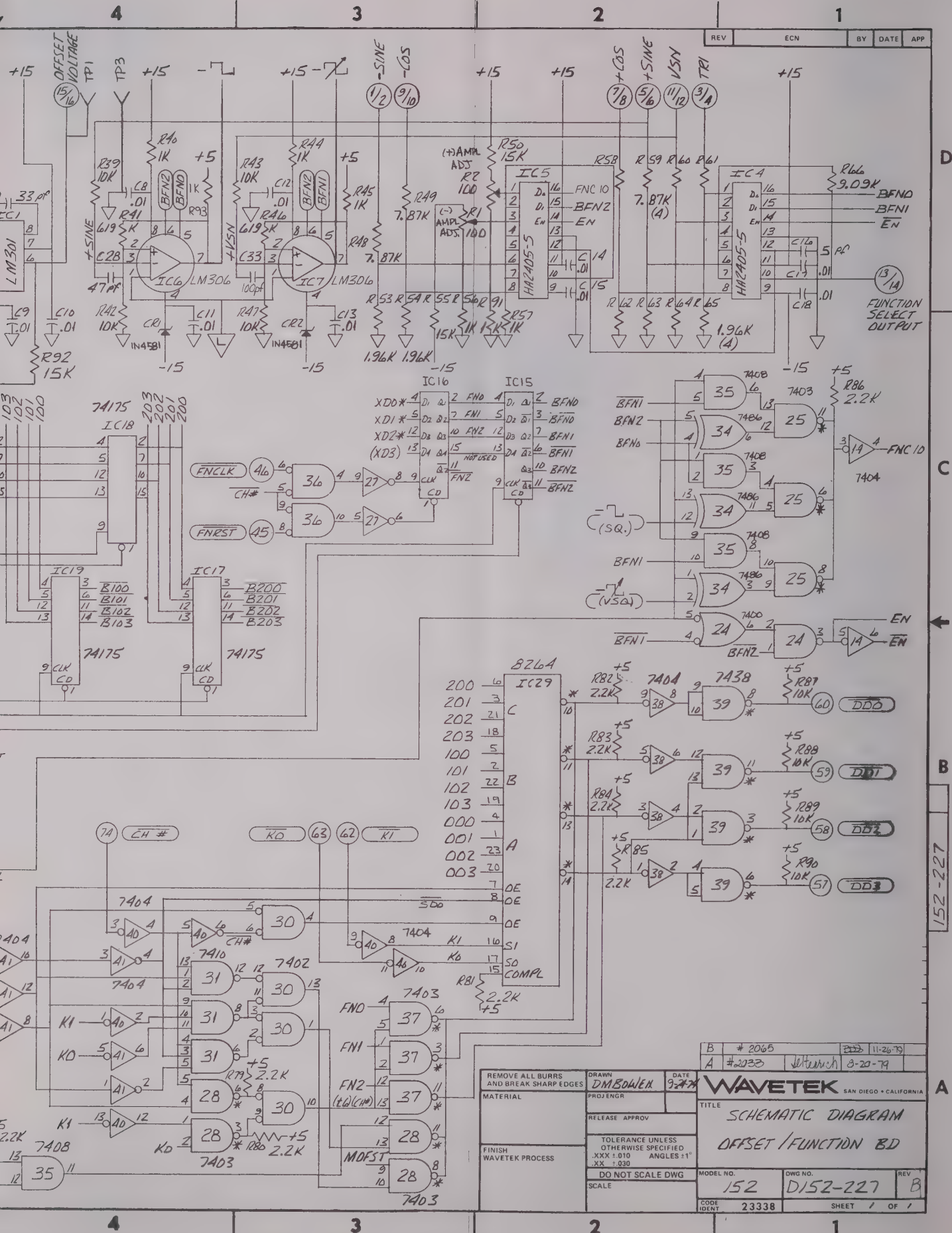
2. ALL CAPACITOR VALUES ARE IN MICROFARADS (μ F)
1. ALL RESISTOR VALUES ARE IN OHMS (Ω).



LAST REF DESIG USED

CAP	C33
DIODE	CR2
RES	R92
INT CIR	IC40
TRAN	Q4

NOTE: UNLESS OTHERWISE SPECIFIED



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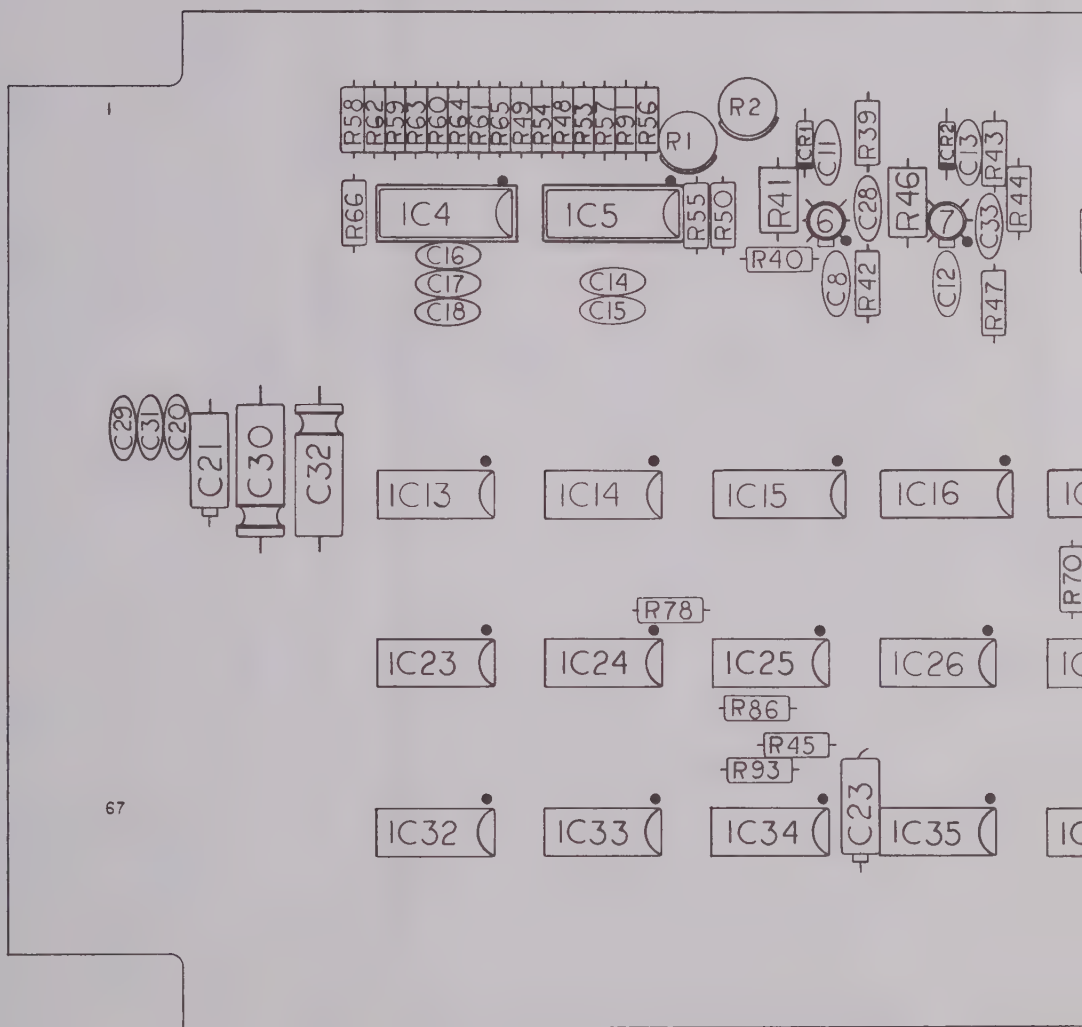
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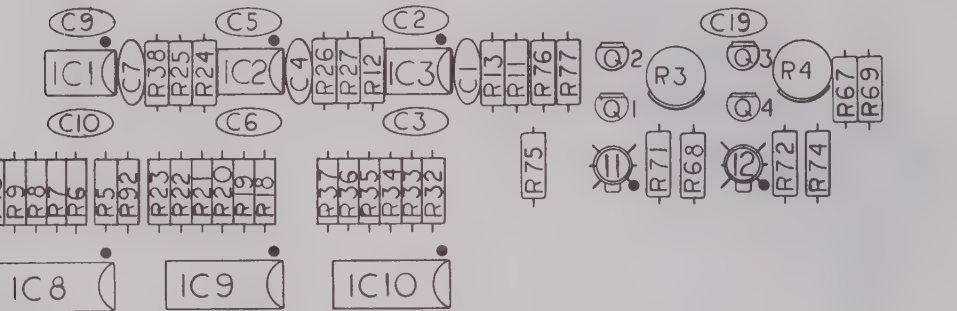
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REV ECN BY DATE APP

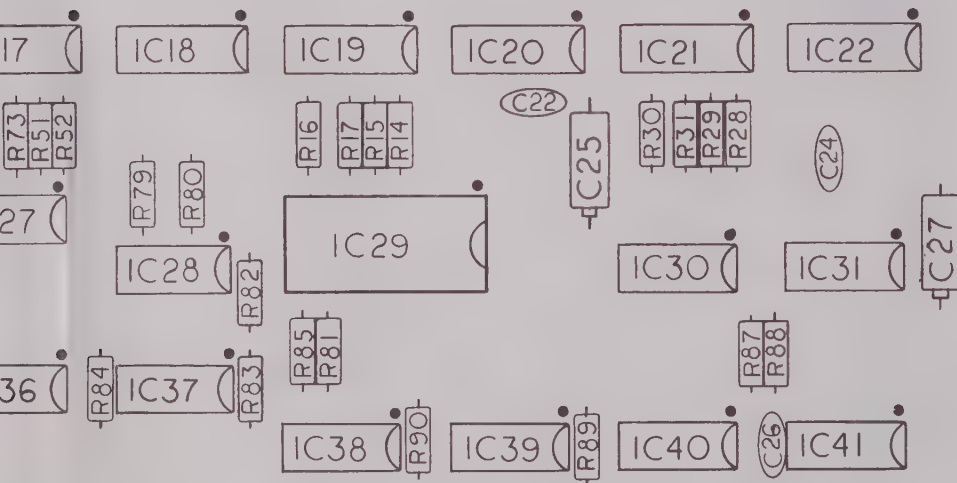
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⊙ — OFFSET/VOLT

⊙ — T. P. 3

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OFFSET/FUNCTION
152-127-2A

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DI52-027

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REMOVE ALL BURRS AND BREAK SHARP EDGES		DRAWN <i>[Signature]</i>		DATE 1-2-77		WAVETEK SAN DIEGO • CALIFORNIA	
MATERIAL		PROJ ENGR		TITLE ASSEMBLY, OFFSET FUNCTION BD		REV	
FINISH WAVETEK PROCESS		RELEASE APPROV		TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± .010 ANGLES ±1 XX ± .030		DO NOT SCALE DWG	
		SCALE		MODEL NO		DWG NO DI52-027	
				CODE IDENT 23338		SHEET OF	

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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG=MFG#
NONE	CAP,CER,5PF,1KV	DD-050
NONE	CAP,CER,.01MF,50V	CK-103
NONE	CAP,CER,33PF,1KV	DD-330
NONE	CAP,CER,47PF,1KV	DD-470
NONE	CAP,ELECT,100MF,16V	500D107G01
NONE	CAP,TANT,33MF,10V	150D336X90
NONE	OFFSET/FUNCTION RD	152-127
NONE	SKT,IC,16PIN	16-DIP
NONE	PIN,MALE	611P2-2
NONE	POT,TRIM,100	91AR100
NONE	POT,TRIM,500	91AR500
NONE	RES,MF,1/8W,1%,100	RN55D-1000
NONE	RES,MF,1/8W,1%,1K	RN55D-1001
NONE	RES,MF,1/8W,1%,10K	RN55D-1002
NONE	RES,MF,1/8W,1%,12.1K	RN55D-1212
NONE	RES,MF,1/8W,1%,13K	RN55D-1302
NONE	RES,MF,1/8W,1%,1.5K	RN55D-1501
NONE	RES,MF,1/8W,1%,15K	RN55D-1502
WAVETEK PARTS LIST		TITLE PCA,OFFSET/FUNCTION

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG=MFG#
NONE	RES,MF,1/8W,1%,1.78K	RN55D-1781
NONE	RES,MF,1/8W,1%,1.96K	RN55D-1961
NONE	RES,MF,1/8W,1%,2.21K	RN55D-2211
NONE	RES,MF,1/8W,1%,33.2	RN55D-3322
NONE	RES,MF,1/8W,1%,7.87K	RN55D-7871
NONE	RES,MF,1/8W,1%,78.7K	RN55D-7872
NONE	RES,MF,1/8W,1%,9.09K	RN55D-9091
NONE	RES,MF,1/4W,1%,619K	RN60D-6193
NONE	DIODE	1N45R1
NONE	TRANS	2N3903
NONE	TRANS	2N3905
NONE	IC	LM301AN
NONE	IC	LM306M
NONE	IC	HA2405-S
NONE	IC	CA-30R0
NONE	IC	5010
NONE	IC	7400
WAVETEK PARTS LIST		TITLE PCA,OFFSET/FUNCTION

NOTE: UNLESS OTHERWISE SPECIFIED

KT-NO	MFGR	WAVETEK NO.	QTY/PT
C7 H2	CRL	1500-00-5011	1
	CRL	1500-01-0310	21
	APCO	1500-03-3011	3
	ARCO	1500-04-7011	2
	SPRAG	1500-31-0101	2
	SPRAG	1500-73-3601	4
	WVTK	1700-00-0148	1
	CTNCH	2100-03-0022	2
	AMP	2100-05-0020	10
	BECK	4600-01-0103	2
	BECK	4600-05-0104	2
	TRW	4701-03-1000	3
	TRW	4701-03-1001	8
	TRW	4701-03-1002	22
	TRW	4701-03-1212	1
	TRW	4701-03-1302	2
	TRW	4701-03-1501	1
	TRW	4701-03-1502	4
ASSEMBLY NO. 100-00-0148			REV
PAGE: 1			

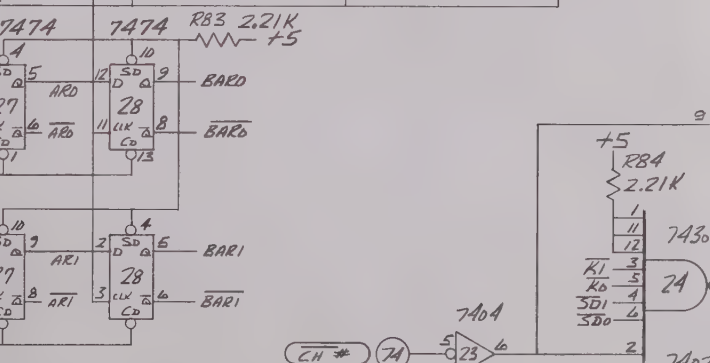
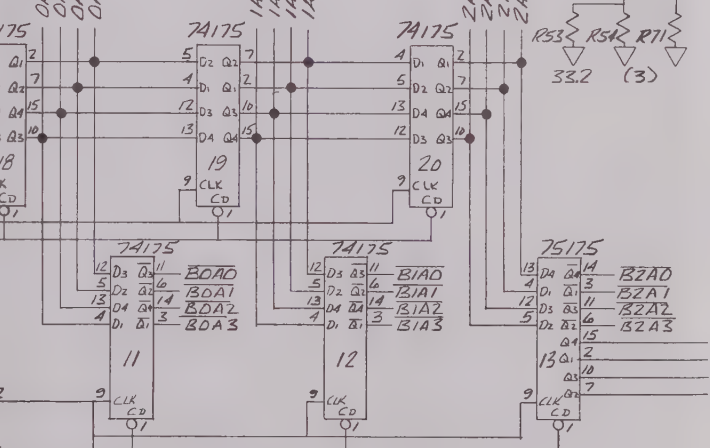
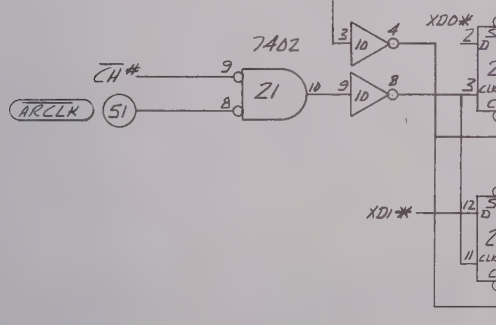
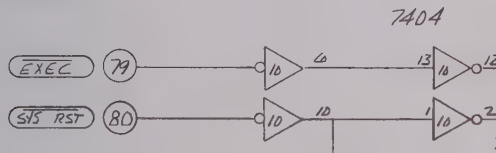
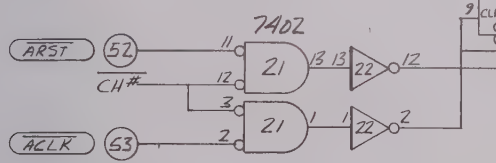
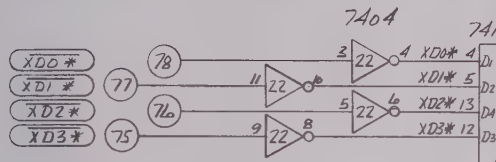
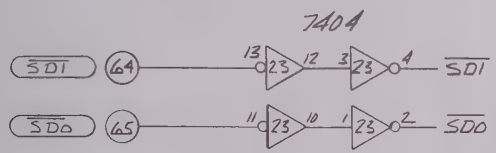
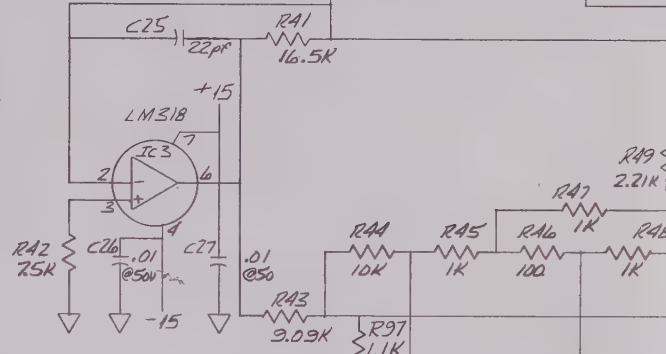
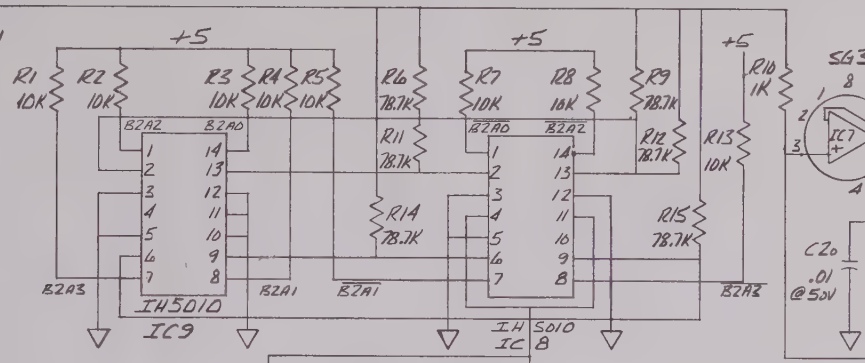
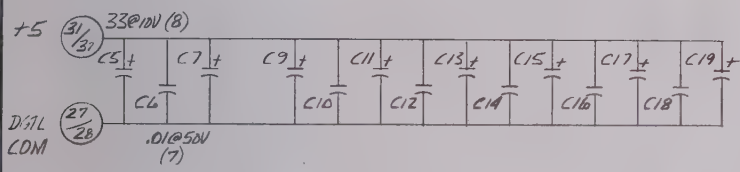
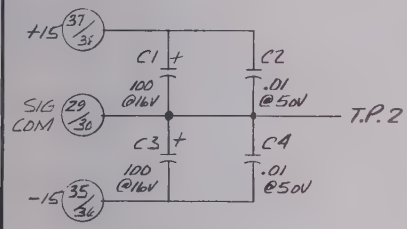
REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG=MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	IC	7402	TI	8000-74-0200	3
NONE	IC	7403	TI	8000-74-0300	3
NONE	IC	7404	TI	8000-74-0400	7
NONE	IC	7408	TI	8000-74-0800	1
NONE	IC	7410	TI	8000-74-1000	1
NONE	IC	7438	TI	8000-74-3800	1
NONE	IC	7486	TI	8000-74-8600	1
NONE	IC	8264	SIG	8000-82-6400	1
NONE	IC	74107	TI	8007-41-0700	2
NONE	IC	74175	TI	8007-41-7500	8
WAVETEK PARTS LIST		TITLE PCA, OFFSET/FUNCTION		ASSEMBLY NO. 1100-00-0148 PAGE: 3	
				REV	

KT-NO	MFGR	WAVETEK NO.	QTY/PT
	TPW	4701-03-1781	2
	TPW	4701-03-1961	6
	TPW	4701-03-2211	10
	TRW	4701-03-3329	3
	TRW	4701-03-7871	6
	TRW	4701-03-7872	18
	TRW	4701-03-9091	1
	TRW	4701-13-6193	2
	MICRO	4901-01-4581	2
	NSC	4901-03-9030	1
	ITT	4901-03-9050	3
	NSC	7000-03-0100	3
	NSC	7000-03-0600	2
	HAKIS	7000-24-0500	2
	RCA	7000-30-8000	2
	INTSL	7000-50-1000	3
	TI	8000-74-0000	1
ASSEMBLY NO. 100-00-0148			REV
PAGE: 2			

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA	
MATERIAL	PROJENGR		TITLE	
	RELEASE	APPROV	PARTS LIST	
FINISH	TOLERANCE UNLESS OTHERWISE SPECIFIED		OFFSET/FUNCTION BOARD	
WAVETEK PROCESS	.XXX ±.010 ANGLES :1° .XX ±.030		MODEL NO	DWG NO
	DO NOT SCALE DWG		152	1100-00-0148
	SCALE		CODE IDENT	REV
			23338	1
			SHEET	OF

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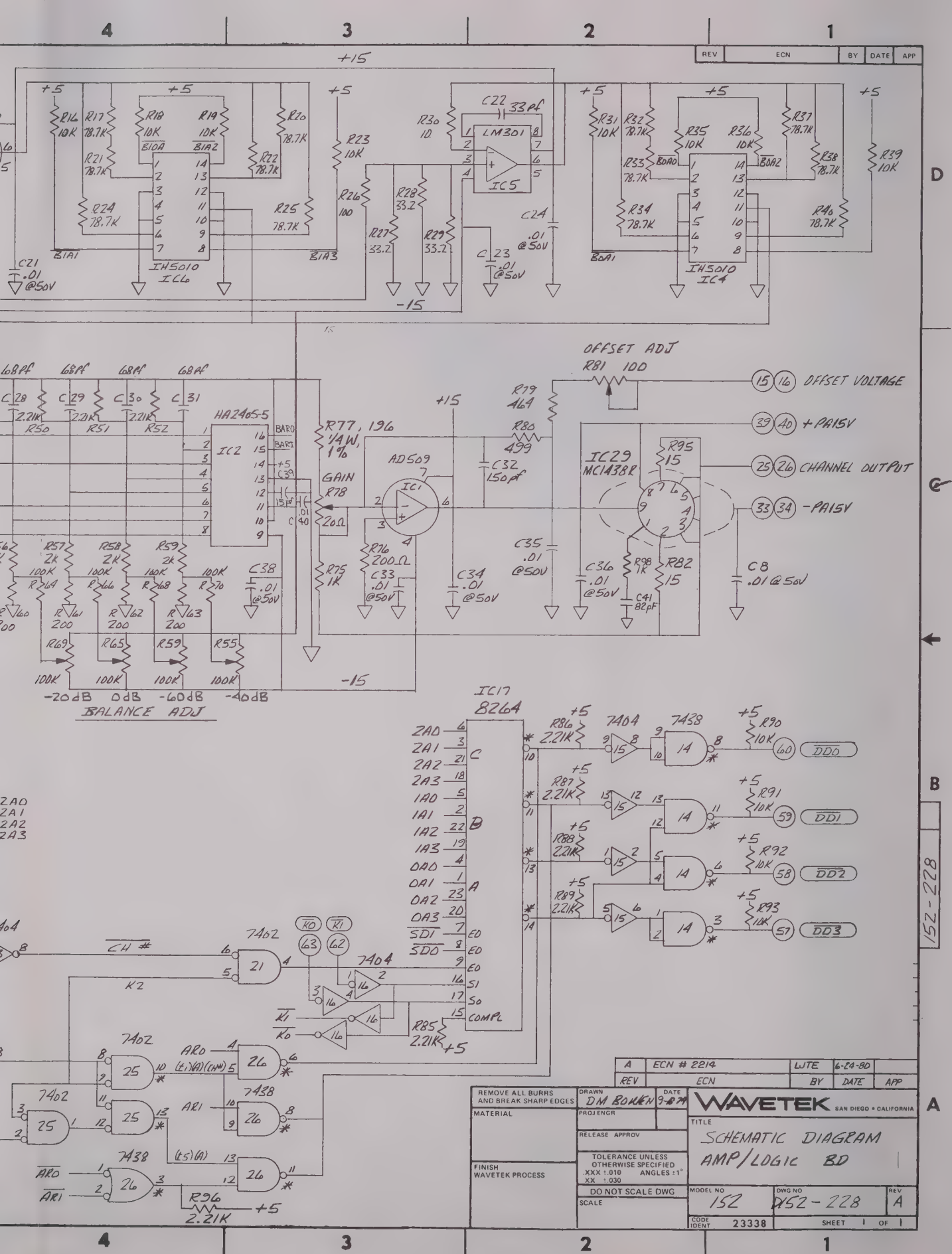
FUNCTION IN
T.P.1



2. ALL CAPACITOR VALUES ARE IN MICROFARADS (μF)
1. ALL RESISTOR VALUES ARE IN OHM (Ω)

LAST REF DESIG USED:
CAP CA1
TRAN A1
RES R98
INT CIR IC28

NOTE: UNLESS OTHERWISE SPECIFIED



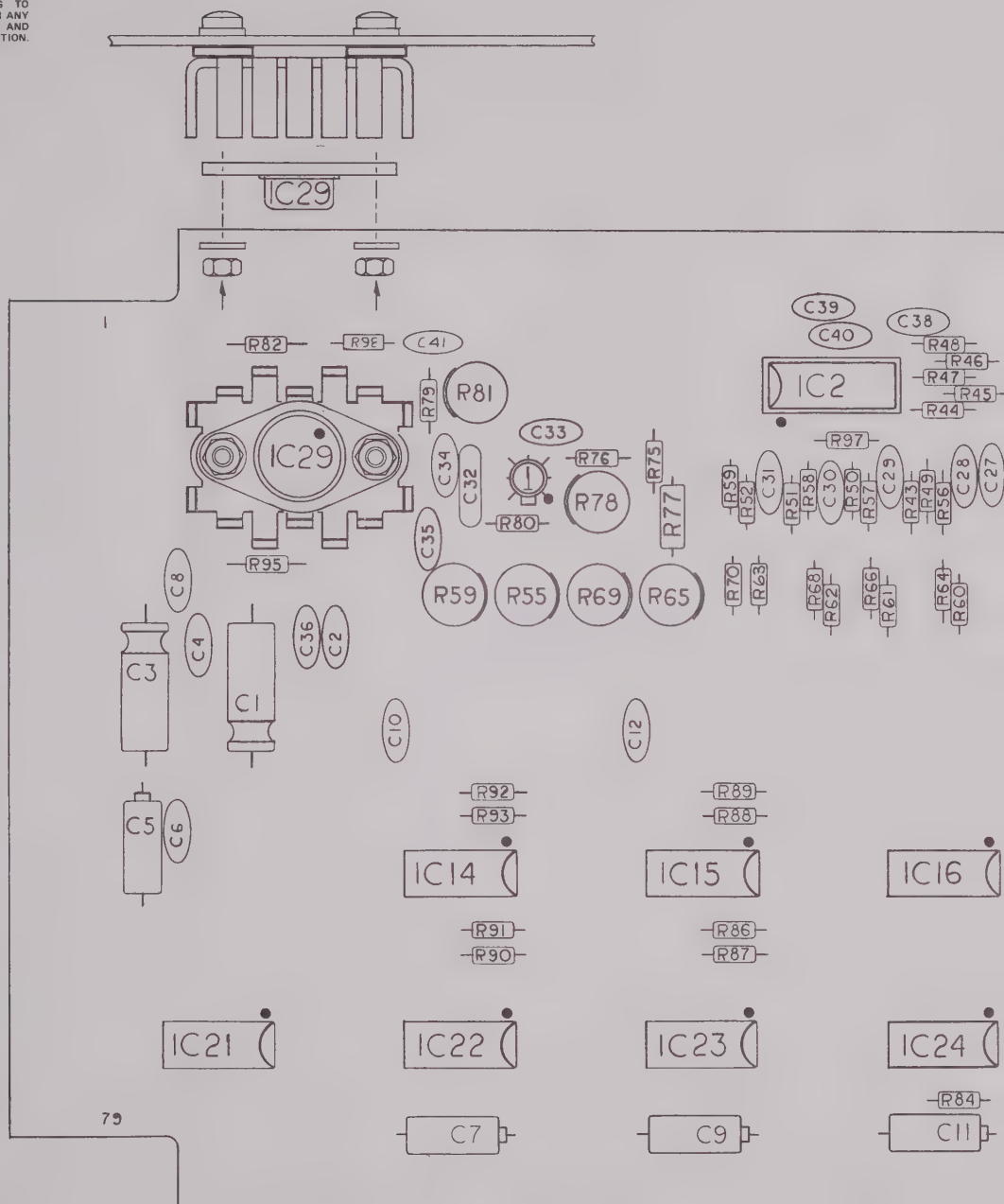
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NOTE UNLESS OTHERWISE SPECIFIED

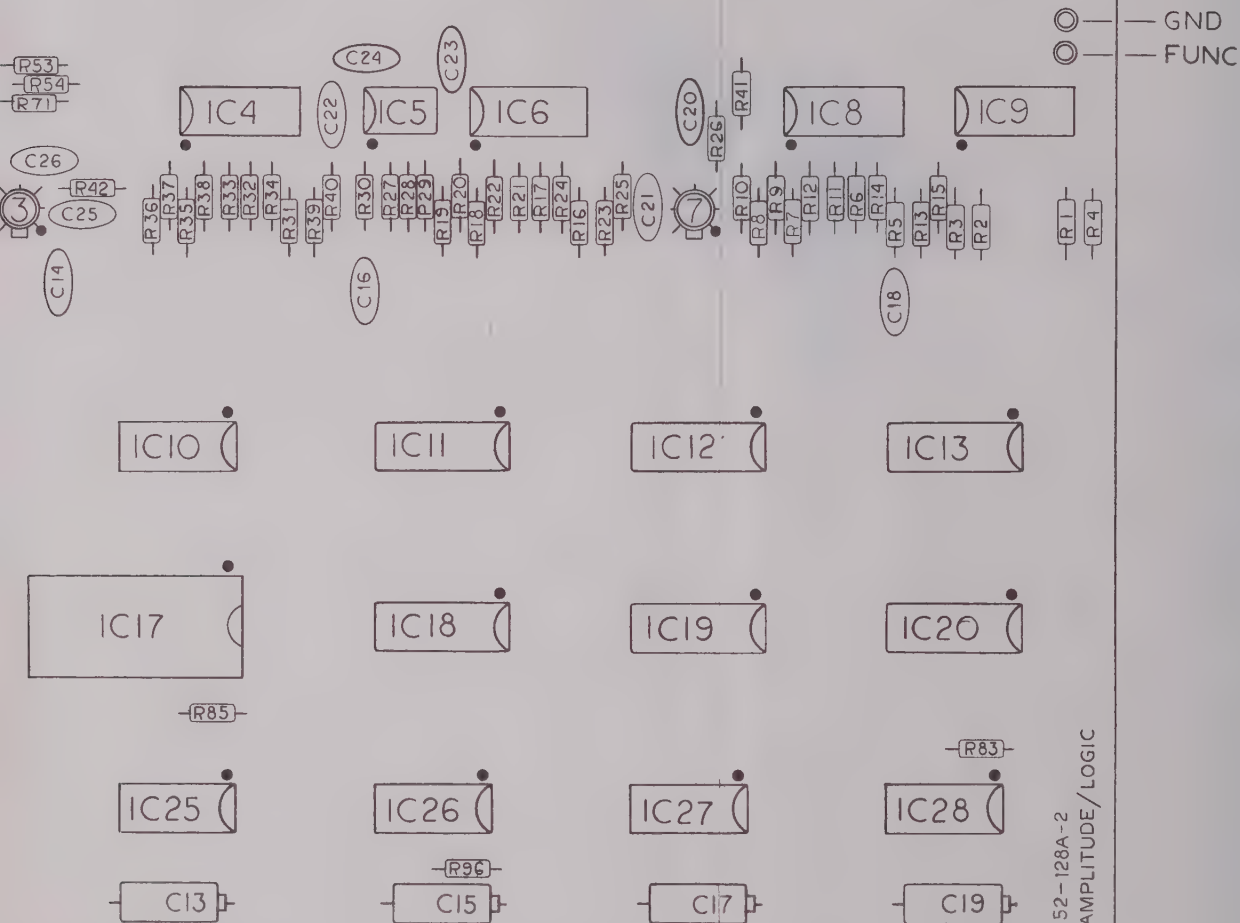
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REV	ECN	BY	DATE	APP
A	ECN # 2214	LJTE	6-24-80	



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DI52-028

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REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN PROF ENGR	DATE 1-27-75	WAVETEK SAN DIEGO • CALIFORNIA	
MATERIAL	RELEASE APPROV		TITLE ASSEMBLY, AMPLITUDE/LOGIC	
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XX .010 ANGLES .1 XX .030		MODEL NO	REV
	DO NOT SCALE DWG		DWG NO DI52-028	A
	SCALE		CODE IDENT	SHEET OF
23338				

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REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-
NONE	HEATSINK, MOD FROM:2800-11-0010	152-326
NONE	CAP,CER,.01MF,50V	CK-103 LONG LEA
NONE	CAP,CER,15PF,1KV	DD-150
NONE	CAP,CER,22PF,1KV	DD-220 LONG LEA
NONE	CAP,CER,33PF,1KV	DD-330 LONG LEA
NONE	CAP,CER,68PF,1KV	DD-680
NONE	CAP,MICA,150PF,500V	DM15-151J
NONE	CAP,ELECT,100MF,16V	500D107G016DC7
NONE	CAP,TANT,33MF,10V	150D336X9010B2
NONE	AMP/LOGIC BOARD	152-126
NONE	SKT,IC,16PIN	16-DIP
NONE	PIN,MALE	61102-2
NONE	POT,TRIM,100	91AR100
NONE	POT,TRIM,100K	91AR100K
NONE	POT,TRIM,20	91AR20
NONE	RES,MF,1/8W,1%,100	RN55D-1000F
NONE	RES,MF,1/8W,1%,1K	RN55D-1001F
WAVETEK PARTS LIST		TITLE PCA, AMP/LOGIC ASSN 1100 PAGE

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REV ECM BY DATE APP

	MFGR	WAVETEK NO.	QTY/PT
	WVTK	1400-00-8669	1
	CRL	1500-01-0300	21
	CRL	1500-01-5011	1
	CHL	1500-02-2001	1
	CKL	1500-03-3001	1
	CHL	1500-06-8001	4
	ARCO	1500-11-5100	1
	SPRAG	1500-31-0101	2
	SPRAG	1500-73-3601	8
	WVTK	1700-00-0147	1
	CINCH	2100-03-0022	1
	AMP	2100-05-0020	2
	BECK	4600-01-0103	1
	BECK	4600-01-0402	4
	BECK	4600-02-0000	1
	TRW	4701-03-1000	2
	TRW	4701-03-1001	5
ASSEMBLY NO. 1100-00-0147			REV

SEE-4 BUSINESS FORMS FROM WVTM, INC. 2187

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	RES,MF,1/8W,1%,10K	RN55D-1002F	TRW	4701-03-1002	21
NONE	RES,MF,1/8W,1%,100K	RN55D-1003F	TRW	4701-03-1003	4
NONE	RES,MF,1/8W,1%,10	RN55D-10R0F	TRW	4701-03-1009	1
NONE	RES,MF,1/8W,1%,1.1K	RN55D-1101F	TRW	4701-03-1101	1
NONE	RES,MF,1/8W,1%,15	RN55D-15R0F	TRW	4701-03-1509	2
NONE	RES,MF,1/8W,1%,16.5K	RN55D-16S2F	TRW	4701-03-1652	1
NONE	RES,MF,1/8W,1%,200	RN55D-2000F	TRW	4701-03-2000	5
NONE	RES,MF,1/8W,1%,2K	RN55D-2001F	TRW	4701-03-2001	4
NONE	RES,MF,1/8W,1%,2.21K	RN55D-2211F	TRW	4701-03-2211	12
NONE	RES,MF,1/8W,1%,33.2	RN55D-33R2F	TRW	4701-03-3329	6
NONE	RES,MF,1/8W,1%,464	RN55D-4640F	TRW	4701-03-4640	1
NONE	RES,MF,1/8,1%,499	RN55D-4990F	TRW	4701-03-4990	1
NONE	RES,MF,1/8W,1%,7.5K	RN55D-7501F	TRW	4701-03-7501	1
NONE	RES,MF,1/8W,1%,78.7K	RN55D-7872F	TRW	4701-03-7872	18
NONE	RES,MF,1/8W,1%,9.09K	RN55D-9091F	TRW	4701-03-9091	1
NONE	RES,MF,1/4W,1%,196	RN60D-1960F	TRW	4701-13-1960	1
NONE	IC	LM 301AN	NSC	7000-03-0100	1
WAVETEK PARTS LIST		TITLE PCA, AMP/LOGIC	ASSEMBLY NO. 1100-00-0147 PAGE: 2		REV

SEE-4 BUSINESS FORMS FROM WVTM, INC. 2187

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	IC	7000-03-1000	WVTK	7000-03-1000	1
NONE	IC	LM318H	NSC	7000-03-1800	1
NONE	IC	AD509JH	ANADV	7000-05-0900	1
NONE	IC	MC1438R	MOT	7000-14-3800	1
NONE	IC	HA2405-5	HAKIS	7000-24-0500	1
NONE	IC	5010	INTSL	7000-50-1000	4
NONE	IC	7402	TI	8000-74-0200	2
NONE	IC	7404	TI	8000-74-0400	5
NONE	IC	7430	TI	8000-74-3000	1
NONE	IC	7438	TI	8000-74-3800	2
NONE	IC	7474	TI	8000-74-7400	2
NONE	IC	8264	SIG	8000-82-6400	1
NONE	IC	74175	TI	8007-41-7500	6
WAVETEK PARTS LIST		TITLE PCA, AMP/LOGIC	ASSEMBLY NO. 1100-00-0147 PAGE: 3		REV

SEE-4 BUSINESS FORMS FROM WVTM, INC. 2187

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN	DATE	WAVETEK SAN DIEGO • CALIFORNIA	
MATERIAL	PROJ ENGR		TITLE AMPLITUDE BD	
	RELEASE	APPROV		
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ±.010 ANGLES ±1° XX ±.030		MODEL NO. 152	DWG NO. 1100-00-0147
	DO NOT SCALE DWG		REV	
SCALE			CODE IDENT 23338	SHEET 1 OF 1

D

C

B

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1

Model 152 Option -005

The -005 option is an interface between the IEC bus and the 'Wavetek ASCII bus'. The IEC input is supplied to a 24-pin amphenol connector on the rear BNC connector panel. The -005 option also provides optical isolation of input data.

Parts Ordering

P.C. Board	152-135	1 ea.
IC	TIL111	10 ea.
Kit	152-035	1 ea.
Connector, 24-pin female amphenol 'Blue'		1 ea.

Instructions for Modification

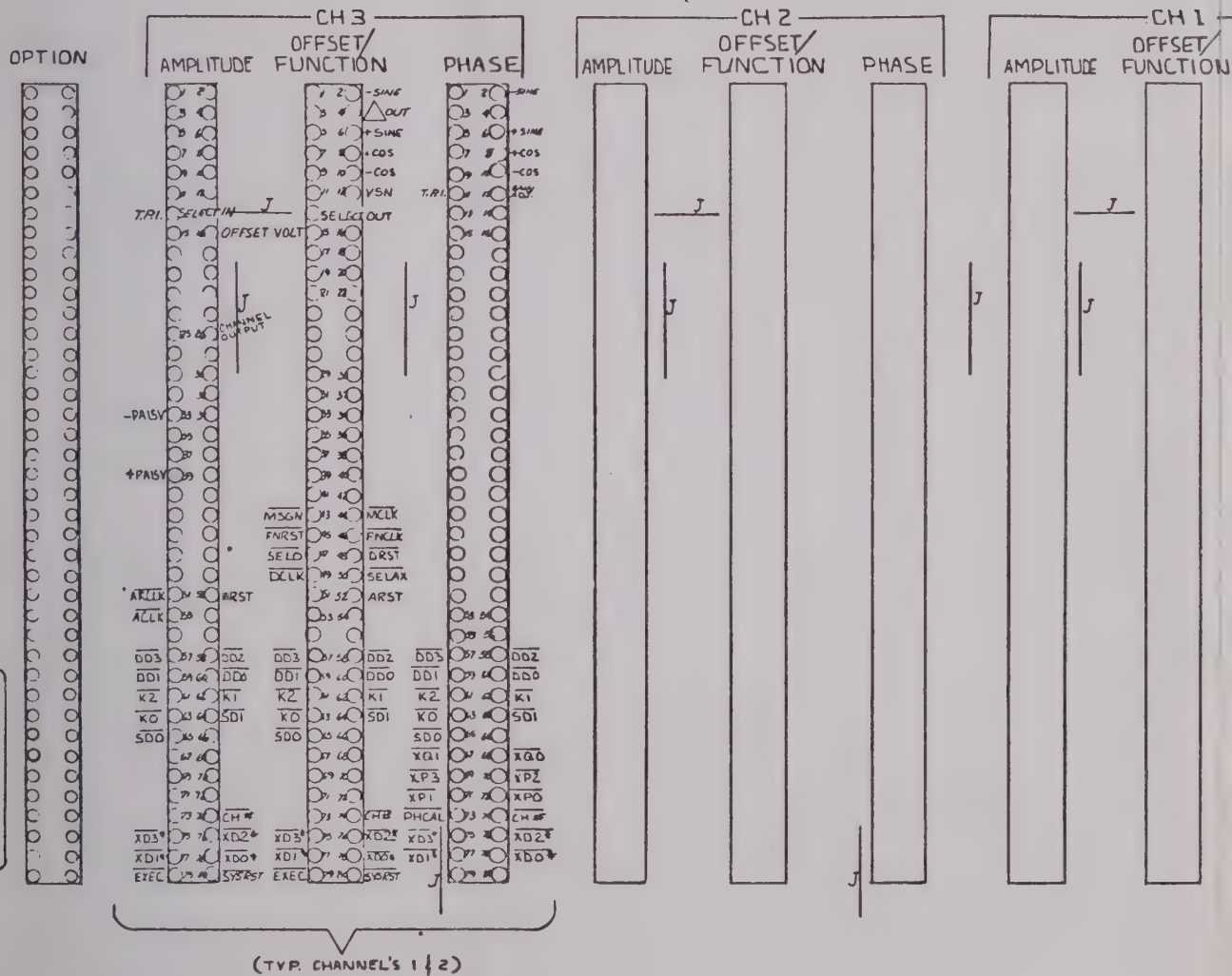
1. Modify Mother Bd. as per drawing.
2. Install cable wiring between 24-pin amphenol connector and interface option connector.

EXTENDER CARD 152-131
STD. INST.

ASSY 152-028
SCHE. 152-228

ASSY 152-027
SCHE. 152-227

ASSY 152-026
SCHE. 152-226

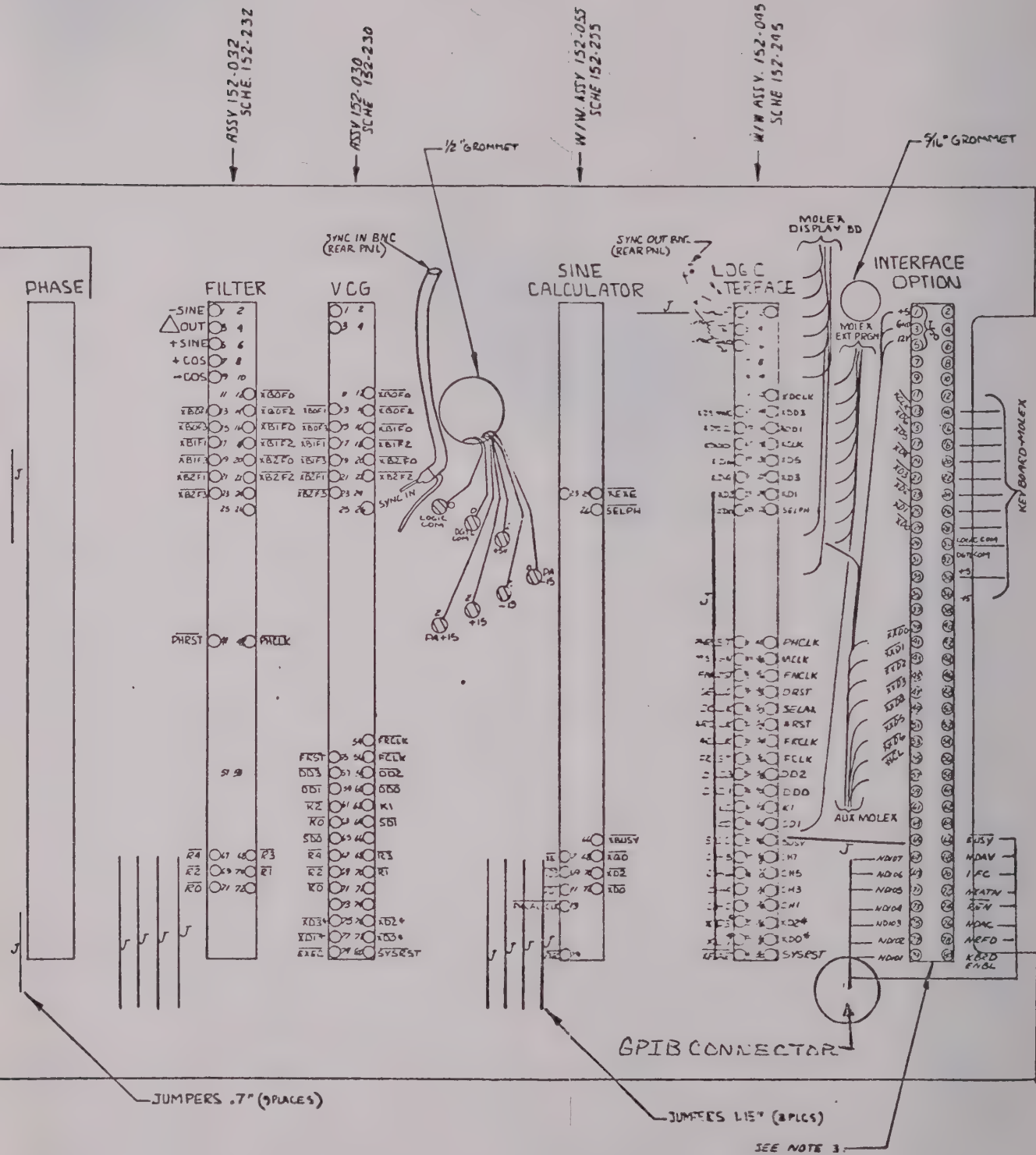


4. ROUTE ALL LABELING TO BRO EDGE UNDER CONN. MTG HOLES.

3. ASSY IEC, ISO, TTY/R3232 OPTION BD, NOT INSTALLED ON STD. MACH..

2. CONN.'S ARE CINCH JONES, 80 PIN CARD CONN., HW4000. (IS PLCS)

NOTES: 1. ASSY. CALLOUTS FOR REF. ONLY.



COMPONENT SIDE

WAVETEK
ASSY MOTHER BD
MODEL 152-005 MOTHER BOARD
D152-034A

1 of 2

3-10-76

Master

Hand-drawn schematic diagram of a circuit board layout. The diagram shows various components including integrated circuits (ICs), resistors (R), capacitors (C), and diodes (D). Components are labeled with their respective values and identifiers. The layout includes a top section with ICs 10 and 11, a middle section with ICs 1, 2, 3, 16, 30, 31, 32, 33, 34, and 42, and a bottom section with ICs 55, 7, 21, and 22. Resistors R1 through R21 and capacitors C1 through C33 are also shown. A power supply section at the bottom left includes a transformer (T35, T36, T37) and a filter capacitor (C20).



4

3

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1

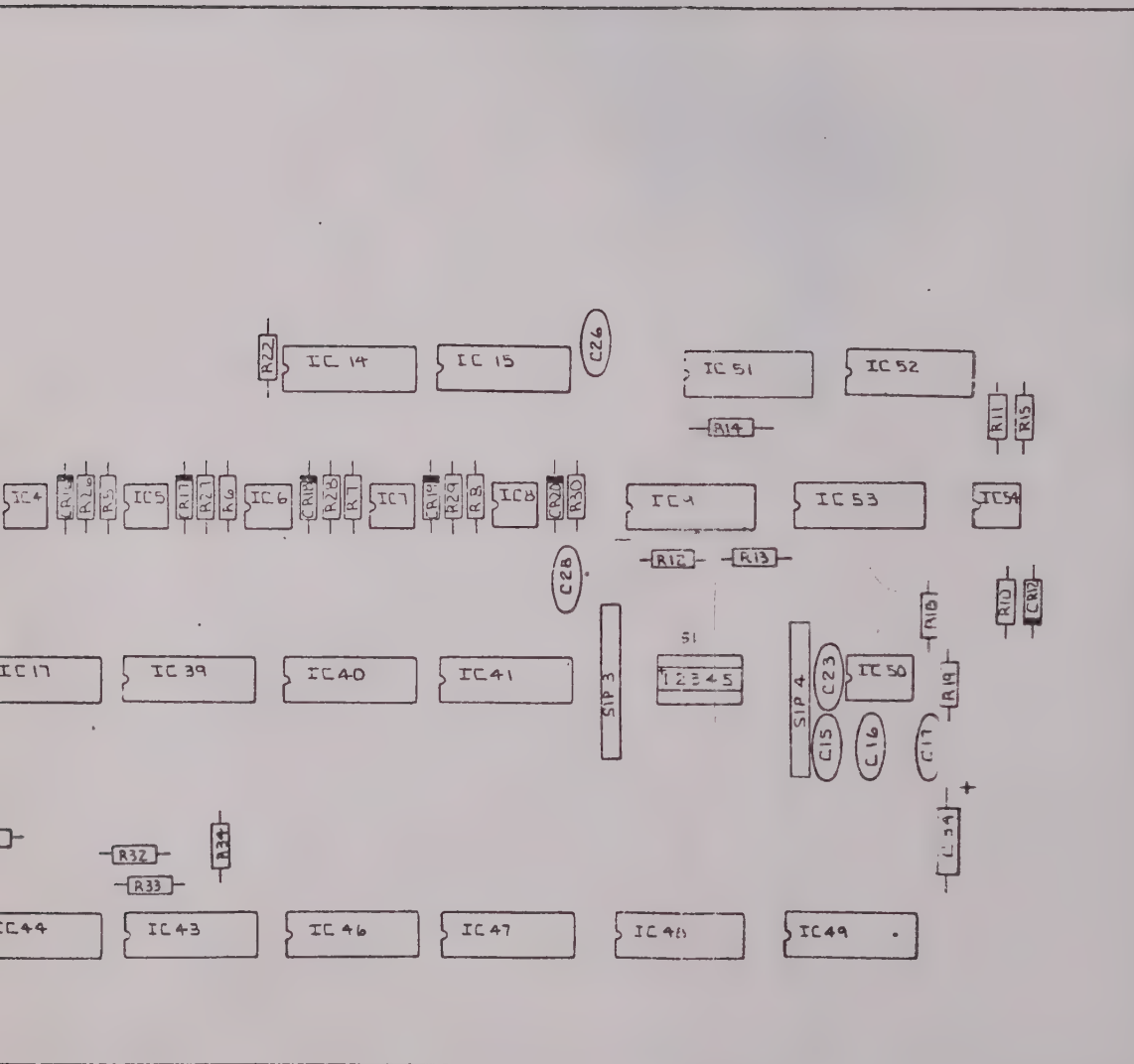
REV	ECN	BY	DATE	APP
1	REVISION	RBG	4/16/78	

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MAY 25 1978

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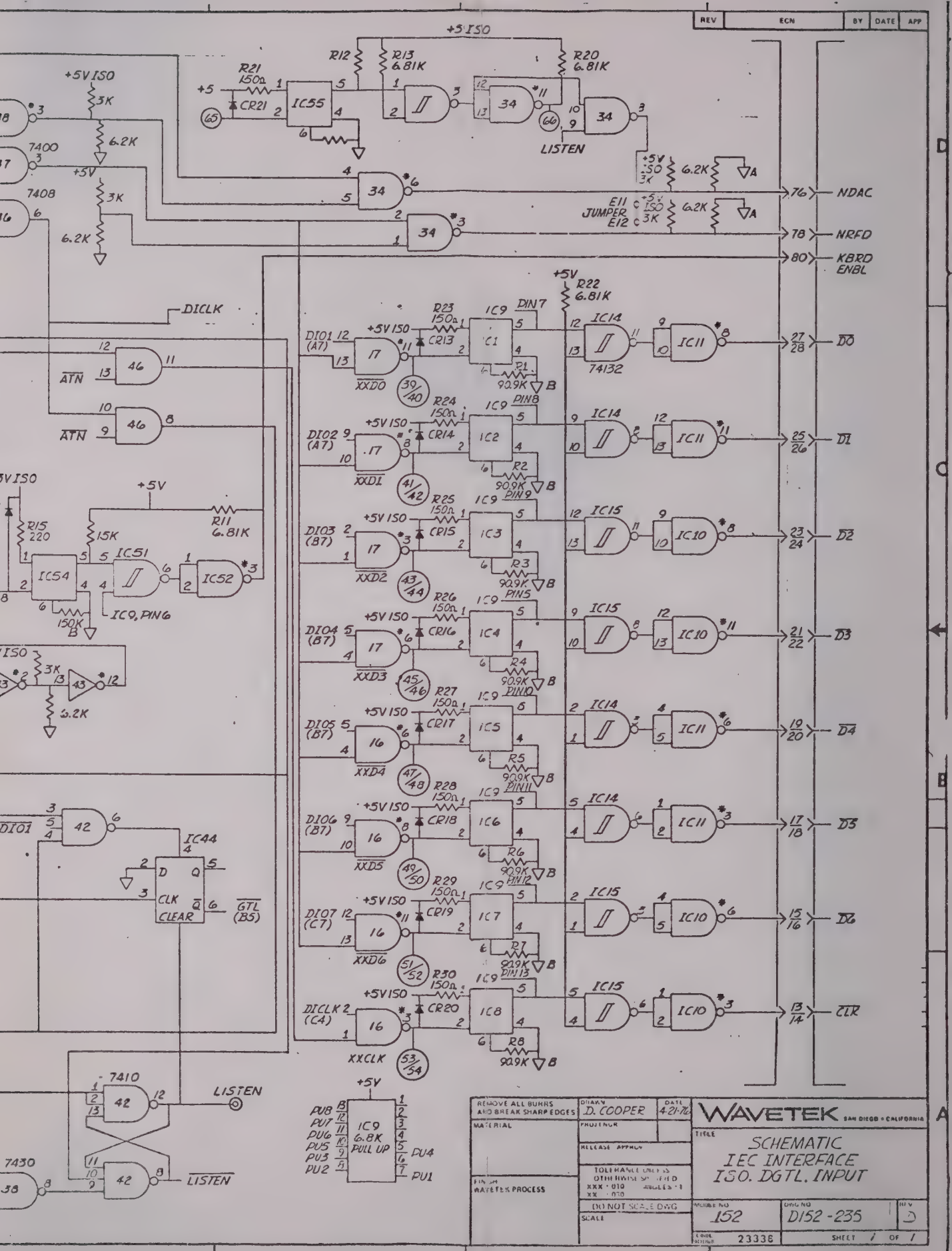
ECN _____



REMOVE ALL B/PS AND REAR SHARP EDGES	DRAWN RBG	DATE 4/16/78	WAVETEK SAN DIEGO • CALIFORNIA	
MATERIAL	PROJENGR		TITLE ASSEMBLY IEC & ISO OPTION BOARD	
	RELEASE APPROV			
FINISH WAVETEK PROCESS	TOLERANCE UNLESS OTHERWISE SPECIFIED XXX ± 0.10 ANGLES °T XX ± 0.30			
	DO NOT SCALE DWG	MOCK NO 152	DWG NO D152-035	REV A
SCALE 2/1		23338	SHEET OF	



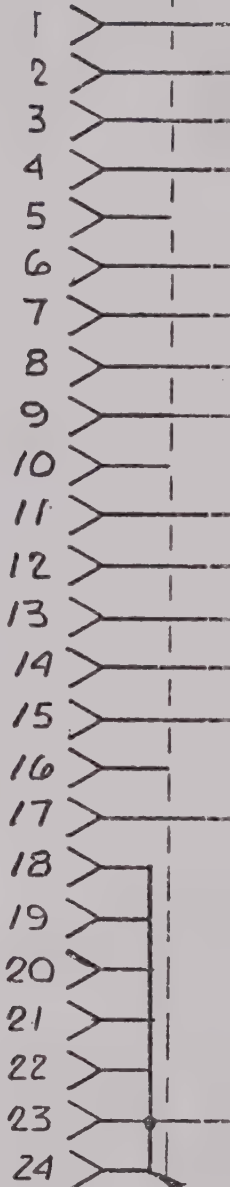
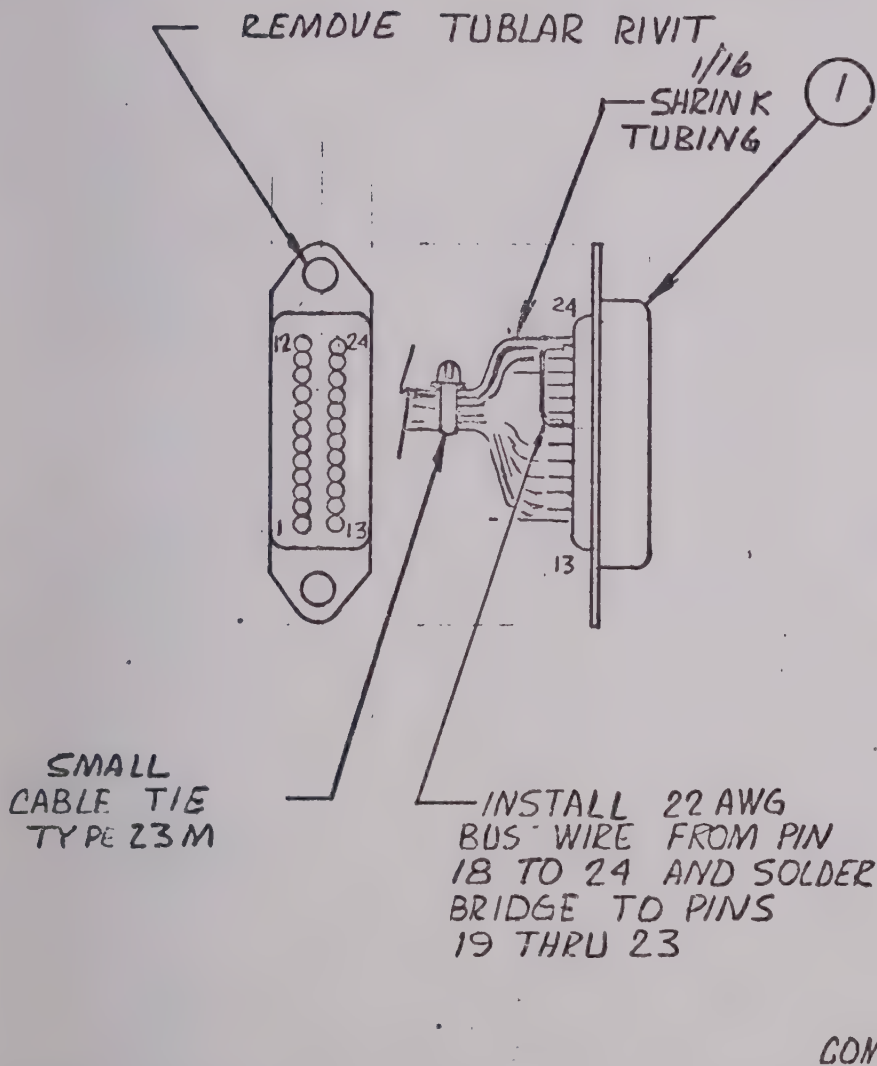
1. CAPS .01 @ 500 UNLESS OTHERWISE SPECIFIED
2. ☐ DENOTES ACTUAL LABELING ON BOARD
- DENOTES: TRUE-WHEN-LOW
4. LAST REF. DESIG. USED: CR20, C23, R37



REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	CAP,CER,.01MF,50V	CK-103	CRL	1500-01-0310	12
NONE	CAP,CER,470PF,1KV	DD-471	CRL	1500-04-7111	1
NONE	CAP,TANT,22MF,15V	196D226X9015KA1	SPRAG	1500-72-2601	1
NONE	CAP,TANT,33MF,10V	150D336X9010B2	SPRAG	1500-73-3601	4
NONE	IEC ISO OPTION BD	152-135	WVTK	1700-00-0679	1
NONE	CONN	57-20240	AMPH	2100-02-0060	1
NONE	JACK SCREW	408-146475	AMPH	2800-23-0008	2
NONE	RES,MF,1/8W,1%,150	RN55D-1500F	TRW	4701-03-1500	9
NONE	RES,MF,1/8W,1%,15K	RN55D-1502F	TRW	4701-03-1502	1
NONE	RES,MF,1/8W,1%,150K	RN55D-1503F	TRW	4701-03-1503	1
NONE	RES,MF,1/8W,1%,221	RN55D-2210F	TRW	4701-03-2210	1
NONE	RES,MF,1/8W,1%,30.1K	RN55D-3012F	TRW	4701-03-3012	1
NONE	RES,MF,1/8W,1%,49.9K	RN55D-4992F	TRW	4701-03-4992	1
NONE	RES,MF,1/8W,1%,6.81K	RN55D-6811F	TRW	4701-03-6811	12
NONE	RES,MF,1/8W,1%,90.9K	RN55D-9092F	TRW	4701-03-9092	9
NONE	RES MODULE	899-1-R6.8K	BECK	4770-00-0003	1
NONE	RESISTOR MOD	159-520	WVTK	4770-00-0005	4
NONE	DIODE	FD-6666	FAIR	4807-02-6666	10
WAVETEK PARTS LIST		TITLE PCA,IEC ISO OPTION		ASSEMBLY NO. 1100-00-0679 PAGE: 1	REV A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/P.T
NONE	LED	TIL-111	TI	4899-00-0012	10
NONE	SWITCH PC	500-105	DUNCN	5199-00-0001	1
NONE	IC	NE555V	SIG	7000-05-5500	1
NONE	IC	7400	TI	8000-74-0000	1
NONE	IC	7404	TI	8000-74-0400	1
NONE	IC	7405	TI	8000-74-0500	3
NONE	IC	7408	TI	8000-74-0800	1
NONE	IC	7410	TI	8000-74-1000	1
NONE	IC	7430	TI	8000-74-3000	1
NONE	IC	7438	TI	8000-74-3800	7
NONE	IC	7474	TI	8000-74-7400	1
NONE	IC	8242	SIG	8000-82-4200	2
NONE	IC	74107	TI	8007-41-0700	1
NONE	IC	74132	TI	8007-41-3200	4
WAVETEK PARTS LIST		ASSEMBLY NO. 1100-00-0679 PAGE: 2		REV A	

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4. SOLDER WIRES TO CONNECTOR AS SHOWN IN DIAGRAM,
3. CUT WIRES TO A LENGTH OF 5.00,

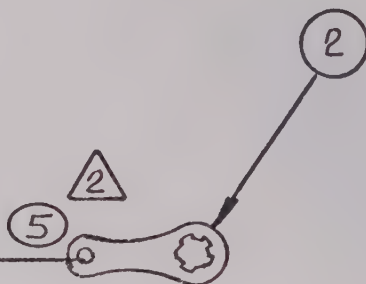
② CUT WIRE TO A LENGTH OF 3.50 AND SOLDER TO LUG

1. ○ DENOTES WIRE COLOR PER RESISTOR COLOR CODE

NOTE: UNLESS OTHERWISE SPECIFIED

76 1/2

N (1)
 D (2)
 RN (3)
 EL (4)
 U (6)
 O (7)
 RY: (8)
 HT (9)
 HT/BRN (91)
 RN (93)
 HT/ORN (94)
 HT/YEL (95)
 HT/GRN (97)
 HT/VIO (98)



REV	ECN	BY	DATE	APP
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MAY 25 1978

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ECN _____

— BUS WIRE

REMOVE ALL BURRS AND BREAK SHARP EDGES	DRAWN BARNETT	DATE 7-29	WAVETEK SAN DIEGO • CALIFORNIA	
	MATERIAL	PROJ ENGR <i>RP Silberman</i>		
FINISH WAVETEK PROCESS	RELEASE APPROV <i>SPR</i>	DATE <i>12/12/74</i>	TITLE CABLE ASSY- IEC OPTION	
	TOLERANCE UNLESS OTHERWISE SPECIFIED .XXX ±.010 ANGLES ±1° .XX ±.030			
	DO NOT SCALE DWG			
	SCALE FULL	MODEL NO. 159	DWG NO. 1203-00-0002	REV
		CODE DEPT 23338	SHEET 1 OF 2	

INTERFACE OPTION CONNECTOR

AMPHENOL CONNECTOR

67	95 ND107	15
68	6 NDAV	6
69	94 ND106	14
70	9 IFL	9
71	93 ND105	13
72	91 NXATN	11
73	4 ND104	4
74	97 REN/	17
75	3 ND103	3
76	8 NDAC	8
77	2 ND102	2
78	7 NRFD	7
79	1 ND101	1
80	3 KBRD	NOTE 1
3/4	98 ISO GND	18-24
	5 CHASSIS GND	12

CONNECT TO
152 CHASSIS

1) To pin 3 External Molex connector

152 OPTION-005
CABLE ASS'Y

APPENDIX A

ADVANCED PROGRAMMING

The Model 152 will accept standard format statements such as:

```
WRITE (10,700) NU, A, F, O, M, NFUNC
```

```
700 FORMAT ("G", I1, "A", E12.2, "F", E12.2, "D",  
F6.2, "B", I1, "C", I1, "I")
```

Where	NU	is unit number
	A	is amplitude value
	F	is frequency value
	O	is offset value
	M	is mode number
	NFUNC	is function code

and literals in quotations are defined in figure 3-1.

For example, the Model 152 would first be sent an ASCII "G" followed by the integer value stored at "NU". The trailing ASCII "I" is the group execute of the generator.

Note that the amplitude or frequency values will be sent to the instrument exactly as they would to a printer; for example, the value 123:

```
A####1.23##02
```

That is, a field 12 characters wide with 2 characters to the right of the decimal point. However, some systems would output:

```
A####.12E##03
```

for the same E12.2 field, and some systems allow formats of the type: 1PE 12.2 which yield:

```
A####1.23E^02
```

for the value 123.

If the 1P modifier is not available, the value can be divided by 10 to decrease the exponent. If the value in variable

"F" were 123,450 (Hz), for example, it could be formatted as:

```
("F", E12.3) or (1HF, E12.3)
```

The result would be a value of 0.12345E6/10 or .12345E5. This would be sent as:

```
F####.123^05
```

The Model 152 would ignore the decimal and place it between the 1 and the 2 resulting in a frequency of 1.23 5 or 123,000 Hz.

Whatever the case, the output must be properly scaled by noting that the instrument retains the last three value digits and ignores previous digits and decimal points in the value field. Similarly, it accepts only the last exponent digit and ignores exponent signs. The exception is phase which retains the last four value digits, places a decimal between the third and fourth, and has no exponent.

Amplitudes are accepted as a three digit value X.XX along with a range digit. The most significant digit can range from 0 to 9 and the decimal is put between the first and second digits. A range digit is always accepted as a negative exponent (divider); a zero for no attenuation, a -1 for 1/10 and a -2 for 1/100 of the output. A computed range digit of +1 would be accepted as a -1, therefore do not attempt to send A0.123E+01.

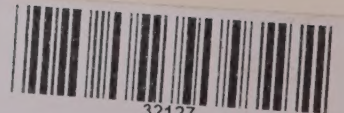
Offset accepts a three digit value X.XX which ranges from 0.00 to ± 9.99 Vdc. Offset is not attenuated and does not accept a range digit.

Frequency is programmed with the same value fields as amplitude. The most significant digit can range from 1 to 9, the decimal is put between the first and second digits, and the exponent is accepted as a positive 0 through 4.

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